NATIONAL MUSEUM OF VICTORIA

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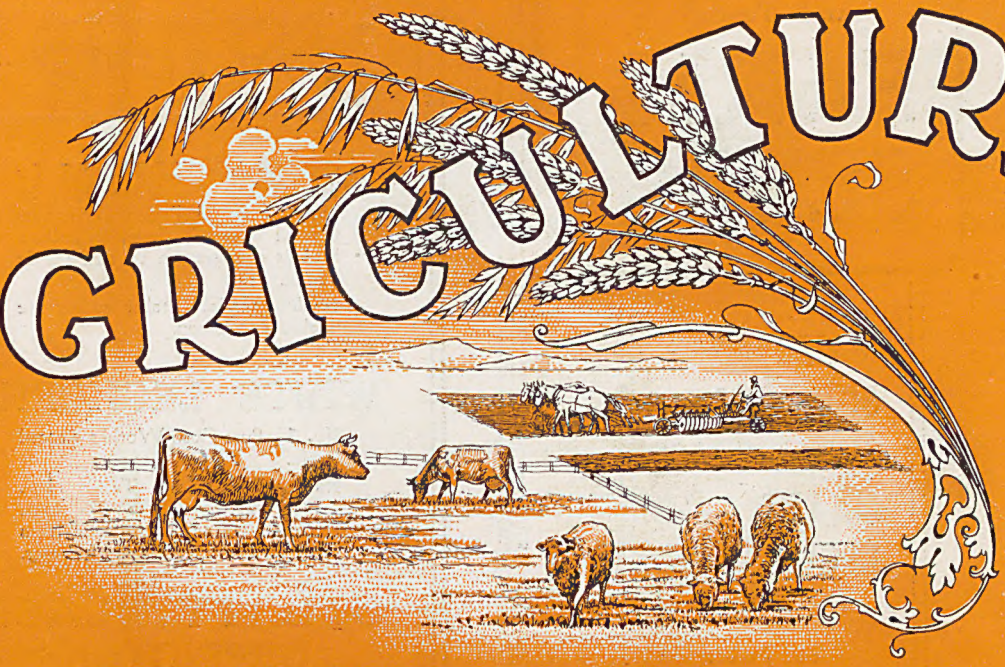

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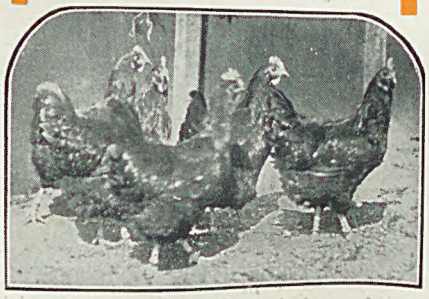

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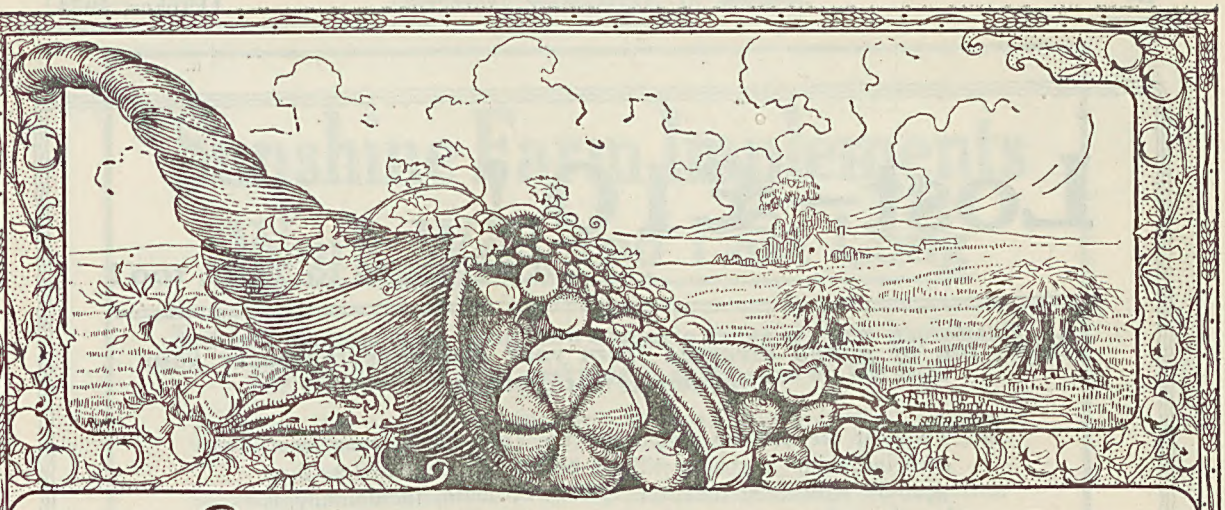

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Issued under the direction of the Hon. W. Slater, M.L.A., Minister of Agriculture.

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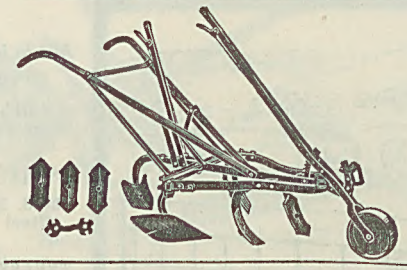

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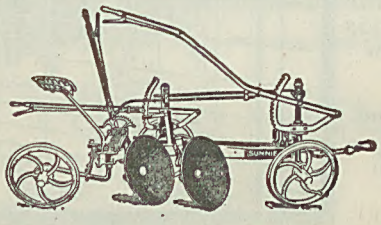

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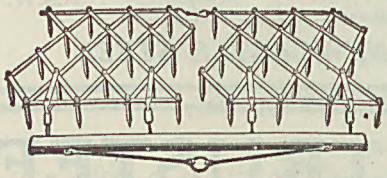

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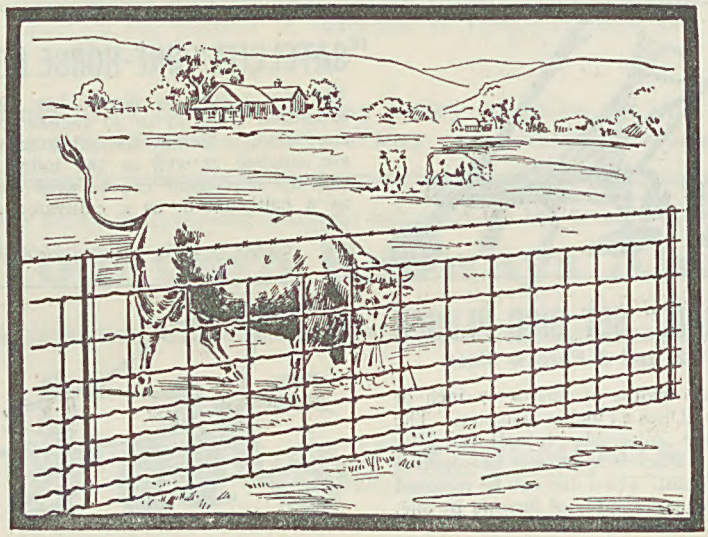

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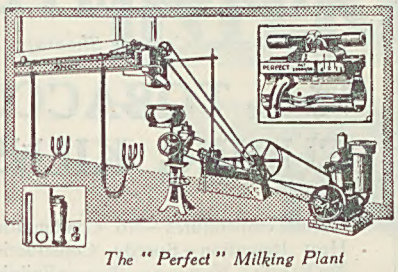

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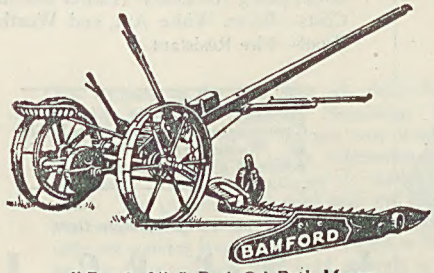

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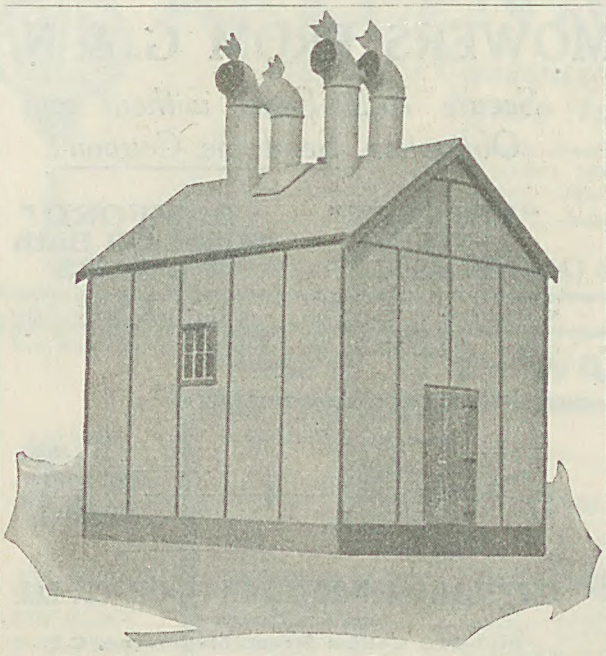

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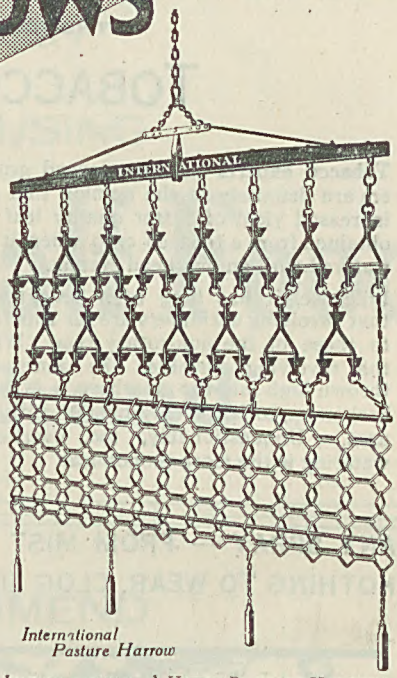

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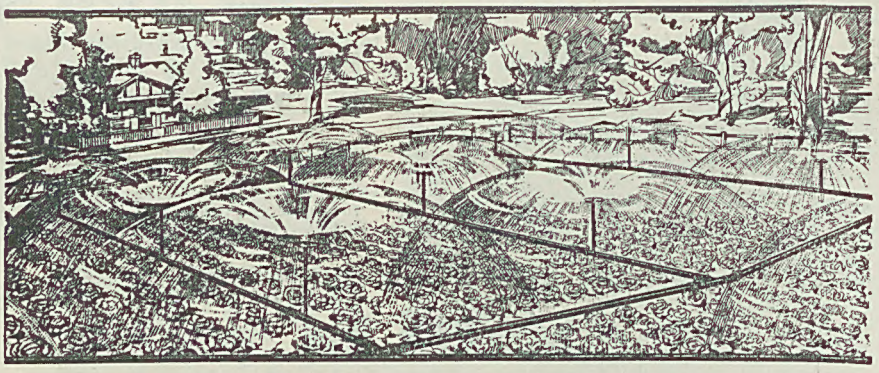

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The Journal of the Department of Agriculture of Victoria

Blue Mould in Tobacco

Hints on its Control

By D. B. Adam, B.Agr.Sc., Plant Pathologist.

IT is generally accepted nowadays that the disease which we call "Blue Mould" is due to the presence of a parasitic fungus within the leaf of the tobacco plant.

Most plant disease control is based on the well known truth that "prevention is better than cure," and blue mould control is no exception to this. Our first interest in this problem lies in the discovery of the means by which the blue mould fungus is in a position to invade the tobacco leaf.

Before we delve into this question, however, it is important to realize that the blue mould fungus is highly specialized; by this we mean that it can, so far as we know, live and reproduce only on living plants, furthermore the living plants on which it can thrive seem to be limited to the cultivated tobacco plant and its botanically close relations. Knowledge concerning the specialised nature of the blue mould is of very great importance, because it enables our keeping better track of the ways by which it is possible for the blue mould fungus to reach the seed-bed.

It is obvious that the fungus may reach the bed in either one of three ways. It may be in the soil before seed is planted. It may be introduced with the seed, or it may be carried by the air or by water to the seed-bed some time after the seed has been sown.

(1) *Soil-borne.*

Although the fungus may be present in the soil of the seed-bed, this is possible only if diseased tobacco plants have previously occupied the beds or diseased tobacco material has in some way been introduced to the bed. There are obvious ways by which this danger can be avoided.

(2) *Seed-borne.*

The risk of disease introduction by this means can be avoided by using seed which has been harvested from tobacco crops known to be free from infection with the blue mould fungus.

(3) *Air-borne.*

Thirdly, and this is the aspect of the problem we are specially concerned with at present, the fungus may be introduced to the bed from sources *outside* the bed. The parts of the fungus likely to be introduced are the minute conidia whose dense mass production constitute the typical blue mould visible to the eye. These conidia, which function like seeds, are very light, and usually are carried about in the air; though water and more substantial objects may assist in their transfer.

We are not sure that we know all these outside sources, but we do know that old stalks in the field that are not killed by winter frosts

The illustration shows a sucker produced early in Spring from an old tobacco plant ploughed in some months previously. The leaves of the sucker were covered with blue mould.

or by ploughing and other cultural operations may carry blue mould infection with them. There is evidence of this in the fact that some of the young leaves of infected plants, when they develop in spring, are covered with blue mould, and if such plants are examined by appropriate means the fungus can be found premeating all parts of the old crown. In actual fact, old plants infected in this way have been found in the field early in spring before there was any evidence of blue mould in the seed-bed. Everything, indeed, points to these old plants with blue mould being *sources* of infection in spring rather than diseased as the result of infection in spring. Other sources of infection arise later in the occurrence of blue mould in neighbouring seed-beds. One can fairly picture seed-beds in a tobacco-growing district after the first week in November being subject to a sustained bombardment of blue mould "bullets" coming from all directions, and, as in any indiscriminate bombardment, a proportion reach the right mark under the right conditions and produce a successful infection *within* the seed-bed. Our experience indicates that once an infection is established within a bed the measures which are recommended later are of very little value in preventing disease extension. The whole aim of the grower should be to prevent any establishment of the disease within the bed itself.

We have then our picture of a bombardment that starts in early spring and becomes heavier as spring advances. Our first step, to continue the simile, is to reduce the enemy artillery, to destroy all old tobacco plants that may be infected with blue mould and are "shooting off" spores. It is particularly important to do this as these old plants undoubtedly play a part in establishing the early infections of the disease each spring. These old plants should be disposed of in such a way that they will not send out young infected leaves in spring. This is best accomplished by pulling out plants in autumn and allowing them to remain wholly exposed to frosts or, better still, carting them away to be burnt in heaps. Ploughing out is only partially satisfactory since many plants are sufficiently

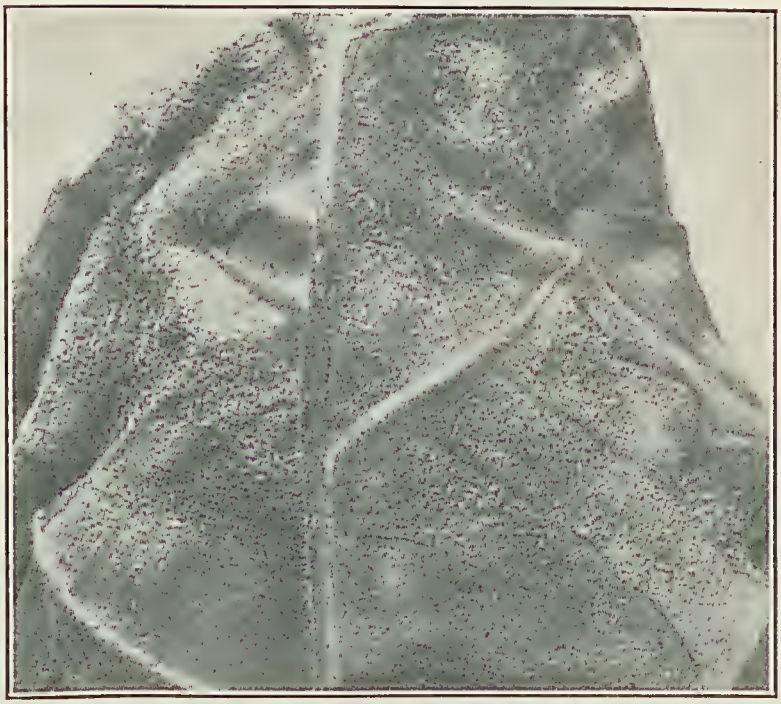
A mature tobacco leaf showing the brown areas caused by blue mould

[Queensland Agricultural Journal.]

well covered to protect them from frost, and they may produce infected leaves in spring.

Although attention to the destruction of old infected plants will reduce the sources of infection and consequently the risk of infection of seed-beds, it is not likely to eliminate completely the risk, because neighbours may be less diligent in the destruction of old plants and, in addition, there may be other outside sources of infection. Growers, therefore, should take measures to protect directly the plants themselves. This protection can be afforded by spraying.

In the question of spraying, the material and the strength of the solution used appear to be less important than the time of application. A spray to be of value for protective purposes must, of course, be applied before the fungus spores capable of causing infection are being deposited on the susceptible leaves.



The Blue Mould Fungus on the under surface of a tobacco leaf.
[*Queensland Agricultural Journal.*]

For a number of years we have made observations under experimental conditions and in the field, and these show that the production of the characteristic blue mould on the leaves is dependent on air temperature and humidity conditions. Under field conditions in early spring air temperature appears to be the more important factor. In the Wangaratta district blue mould has been observed on old suckers about the middle of October. Our opportunities for studying this matter have been very limited, but because of air temperature conditions in the Wangaratta district, and our growing knowledge concerning the fungus, it is not thought that it will be found to occur much before this time on plants that are normally exposed. In this connexion it is interesting to note, from figures kindly supplied by the Commonwealth Meteorological Bureau, that the mean monthly temperature at Wangaratta for August is 49° Fahr.; for September it is 52.5° Fahr.; for October it is 58° Fahr.; for November 59° Fahr.

Sufficient has been said above to show that in districts with temperature conditions similar to Wangaratta, the first spray application should be made not later than the 15th October. Earlier application probably is advisable in warmer districts or in seasons that promise to be early. Subsequent sprayings should be guided by the rate at which seedlings are growing, and to a lesser extent by the washing off of the spray which, normally, is not very marked. In north-eastern districts spraying at fortnightly to ten days' intervals during October and from weekly to five-day periods during November, until seedlings are set out generally, provides sufficient cover. The period between sprayings should be shortened progressively as the seedlings increase in their rate of growth.

A 1 per cent. Bordeaux mixture (4.4.40) is recommended as a spray. The best kind of Bordeaux mixture that we know of is the home-made one. This mixture can be made in the following way:—

A stock solution is prepared by dissolving bluestone at the rate of 1 lb. to 1 gallon of water. Solution can most easily be effected by tying the crystals in a piece of muslin or bagging, and suspending the improvised bag so that it just dips into the surface of the

(*Continued on page* 476.)

Tobacco Growing

III.—Care of the Crop.

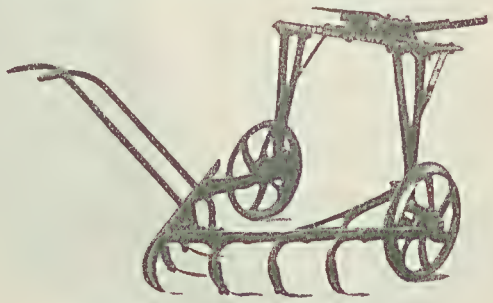
By W. J. B. McDonald, B.Agr.Sc., Assistant Inspector of Agriculture; and G. E. Coghlan, Tobacco Field Officer.

The first Article of this Series which appeared in the August issue of the Journal dealt with the soil and Climatic conditions most suitable for Tobacco growing and the preparation of Seed beds. The second Article in the September issue described the methods of transplanting the seedlings.

THE percentage of seedlings that becomes established in the field depends partly on the degree of care exercised by the grower, and partly on weather conditions during and immediately after the transplanting period. While many growers obtain a 90 per cent. strike, the average over the whole of the tobacco-growing areas is probably not in excess of 75 per cent. To obtain the greatest possible return per acre, it is essential that growers should replace those seedlings which fail to survive transplanting. Within ten days of completion of the first day's transplanting, all seedlings which have died or which show signs of distress must be replaced with healthy plants. It is very seldom that transplanting operations can be carried out on each consecutive day, consequently it should not be difficult to find time to carry out the necessary work entailed in "mending the row."

If this replacement of failures in the field is not attended to, an appreciable proportion of potentially productive land is not being utilized although, for the well-being of the existing plants, this area must be kept weeded and cultivated. Obviously the labour and expense involved in caring for unproductive portions of the field is a net loss.

Tobacco is essentially a rapid-growing crop, making a heavy demand on soil resources during its period of greatest activity. To provide for its needs, the soil must be kept in that condition in which it most readily satisfies the demands made upon it. This can be achieved only by constant cultivation during the growing period of the crop. By so doing weeds are destroyed, the surface soil is kept loose and friable, and the greatest possible conservation of moisture is effected.



A Horse-drawn Row Cultivator.

Weeds are serious competitors for moisture and plant foods, a big bulk of this useless herbage developing always at the expense of the crop the grower wishes to foster. If allowed to grow unchecked, weeds invariably cause a slowing down in the rate of growth of the tobacco plant. This, in turn, affects the quality of the leaf. Weeds are most easily killed just before they reach the surface, consequently the first inter-cultivation must not be delayed unnecessarily. It can be undertaken without injury to the young plant in from ten to fourteen days after setting out, provided care be taken not to approach closer than 6 inches to either row. This initial cultivation should be not more than 3 inches in depth. A deep working in close proximity to the row would tend to unduly loosen or dislodge the soil in which the young plant has been set. This would burst the mass of earth in which the roots are incorporated, resulting in injury and drying out, followed by death. The area necessarily missed by the horse hoe should be hand-hoed immediately.

In using the hand hoe close to the seedings care must be taken not to cut deeply enough

to injure the roots, nor approach sufficiently close to the plant to bruise the leaves or stalk. Should the hoe be driven right under the plants the soil is disturbed in the same manner as it would be by deep cultivation too close to the row. In all cultural operations the grower should avoid covering the seedlings with earth. Should a clod lodge on the young seedling the heart may be damaged and the stalk diverted from its upright habit. The hoe should be used in such a fashion that the soil is drawn toward, rather than away from the base of the seedling.

Apart from the destruction of weed growth, cultivation maintains the surface soil in a condition most favorable to continuous plant growth. This condition is allied partly to moisture conservation and partly to the elaboration of plant foods.

The period elapsing between successive cultivations should be not greater than two to three weeks. The second cultivation can be the deepest of the series, but should not exceed the depth of the second ploughing. As the roots of the plant rapidly grow and fill the row, subsequent cultivations should become progressively shallower until the top soil is being merely scratched. With a single-row horse hoe one man could cultivate 5 acres per day. By the time one worker has completed hand hoeing the area missed by the horse hoe, it is time to commence the next horse-drawn cultivation.

This work should not be continued after the plants have reached such a size that the leaves suffer injury through contact with the swing bars or any portion of the machine. Various machines to facilitate inter-row cultivation have been put on the market. These include single and double row cultivators, and horse-drawn cultivators so designed as to eliminate a large proportion of the necessary hand hoeing. The grower must decide which is the most efficient and economical for his particular purpose.

During the early history of the plant continual war must be waged against cutworm and caterpillar attacks. As suggested previously, dipping the seedlings in arsenate of lead could be expected, under normal weather conditions, to protect them for a period of approximately fourteen days. At the expiration of this time further protection should be afforded by dusting the plants with one of the following mixtures:—1 lb. of arsenate of lead in 30 lb. of pollard, or 1 lb. of Paris green in 25 lb. of pollard. These mixtures are particularly effective in controlling caterpillars. Should cutworms be present in appreciable numbers, the following bait proves quite effective in destroying them:—

> Mix 1 lb. of arsenate of lead with 25 lb. of bran, which is brought to a doughy condition by adding water sweetened with molasses, treacle, or honey. This is rubbed into pellets and distributed towards evening in the affected areas.

Whilst hand hoeing close to the seedlings, a sharp watch should be kept for cutworms. During the warmer parts of the day these harbour just under ground level. Indeed, when performing any operation in the field, attention should be given to the destruction of any pests noticed on the foliage of the plant. If searching for caterpillars during the day, they usually are found on the under surface of the lower leaves.

In applying the dusts mentioned above, two methods are most widely used. In both cases the apparatus is crude but effective, and easily constructed on the farm. The first of these consists of a tin with small perforations in the centre of the base, attached to a stick or convenient handle. The tin is filled with the mixture, and by means of a sharp jerk immediately above the plant a small quantity is distributed over the heart and upper surface of the seedling.

In the second method, the mixture is placed in a fine porous bag which is tied to some support. By administering a blow to the support when the bag is held over a seedling, a small amount of the dust is distributed over those portions of the plant most liable to caterpillar attack.

Dusting operations should be continued at fortnightly intervals until the time at which topping takes place. If flour is substituted for pollard in the above mixtures, there is a danger, especially when using the Paris green mixture, of burning the foilage should rain follow soon after the dusting operation.

Irrigation.

Over a great part of Victoria, the summer rainfall is not sufficient for the production of tobacco. In such districts its growth is possible only when irrigation water is available and, even in the wetter districts relying mainly

on seasonal rains, a complementary irrigation is found distinctly advantageous.

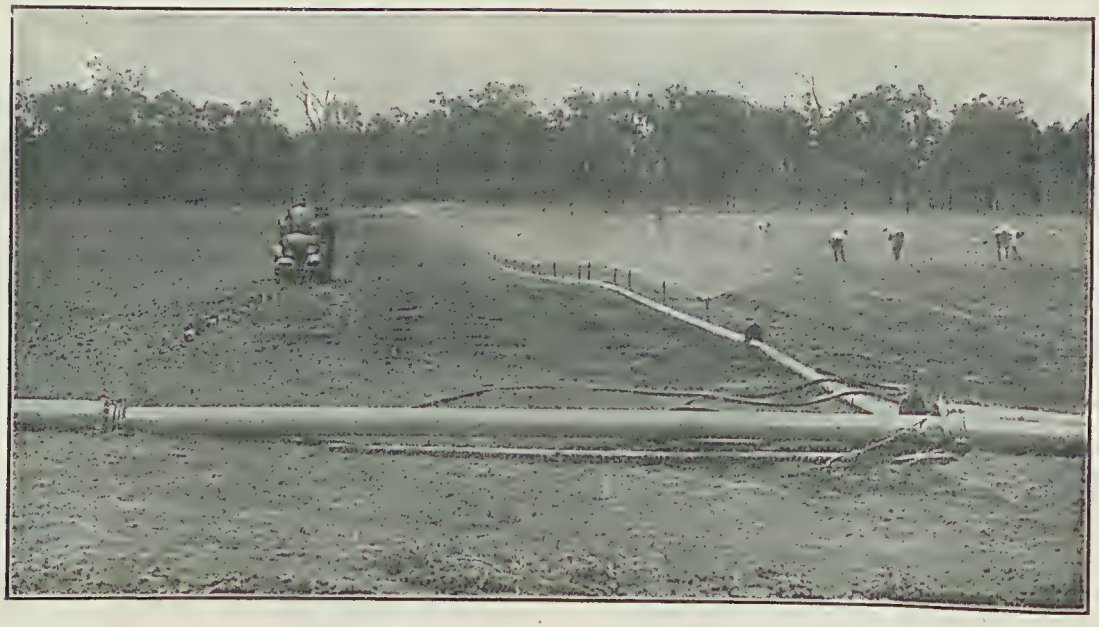
As continuous growth is necessary to successful production, the rate and time of application of the water are of great importance. Under continued dry weather conditions water should be applied before the plants show signs of wilting or losing vigorous growth. If transplanting under dry conditions, it is better to irrigate prior to than subsequent to setting the plants in the field. If the land is irrigated prior to transplanting, it should be lightly cultivated before the seedlings are set.

The tobacco plant cannot stand excess moisture, various ills being associated with this condition. Diseases generally are encouraged, especially Blue Mould and various root rots. Successful irrigation, therefore, depends on careful application of water, combined with adequate drainage, too much water being more harmful than too little. The number of waterings given in any one season naturally will be influenced by the incidence of summer rains. Continuity of growth rather than soil saturation should be the aim of the irrigator.

Flooding of the field should never be attempted. Where the nature of the soil permits its use, furrow irrigation has been employed quite successfully. With this method the water should be distributed through a furrow down the centre of each row, or, in soils where the lateral movement of the water is very rapid, down the centre of each second row. In very porous soils, the length of run should not be sufficiently long to allow excess saturation of the soil at the head of the run before the water reaches the bottom. This danger becomes intensified in very flat country.

In some soils the application of water by means of furrow irrigation is impossible. This necessitates the use of overhead sprays, which under all circumstances are considered a more ideal method. This means of irrigation affords a better control and more economical use of the water available besides ensuring more uniform distribution. It is considered that the slight increase in atmospheric humidity should tend toward the production of a more elastic type of leaf. The actual washing of the foliage also may have some beneficial effect on the plant as a whole.

The greatest drawback to its more widespread use is the initial cost of installation, but where a grower contemplates tobacco culture under irrigation as a permanent farm activity the installation of a spray system probably would be warranted. The cost of the necessary plant, complete with pump and engine, sufficient to irrigate 5 acres, is just under £200. Without the engine the plant could be purchased for about £100. This installation would distribute 1 acre inch in four hours.



Irrigating tobacco on the Queensland property of Messrs. W. D. & H. O. Wills.

Irrigation should never be practised without a complementary cultivation. As soon as the ground will carry horses and implements without bogging or pugging cultivation should be commenced. This helps to conserve the moisture and destroy the weed growth that the water encourages.

Topping and Suckering.

The natural objective of the tobacco plant is the production of seed. In achieving this end the plant foods elaborated by the leaf are largely ultilized in nourishing the seed head. The tobacco-grower endeavours to keep these juices in the leaf by preventing artificially the production of seed and thus forcing to some extent leaf growth. This is done by an operation technically known as "topping." Briefly, this consists of removing the seed head shortly after it emerges. According to seasonal conditions the seed head makes its appearance from eight to ten weeks after transplanting. These will not all emerge at the same date, but to avoid multiplication of effort and to ensure as far as possible uniform maturity, each block of the plantation is topped at one operation. This takes place when the bulk of the seed heads are borne on stalks about 4 inches long.

Spray Irrigation of Tobacco.

The stalk is grasped firmly in the hand and broken off over the heel of the palm. Where the seed head is just emerging from its protecting leaves, it is taken by the thumb and forefinger and pinched out. At all times bruising of the leaves must be avoided. A normally strong plant will mature 14 to 16 leaves, and this determines the height to which the plant must be topped. In considering the number of leaves left on the plant the bottom leaves—sand lugs—which suffer damage through contact with the earth are not included. The number of these will vary according to variety, tall-growing varieties possessing fewer than varieties with a squat habit of growth. These sand lugs can be removed at the same time as the seed head.

Weak or spindly plants should be left with fewer leaves than a normal one. The maximum number which individual plants can mature is determined only after keen observation and considerable experience.

After the removal of the seed head the plant makes a further effort to perpetuate itself. This results in the production of suckers at the axil of the leaf stalk and the main stem. These, if left, rob the leaf of its nutriment with a resultant loss of size and quality.

Suckering or the removal of these suckers is the most tedious of all the operations connected with tobacco-growing and, owing to its unpleasant nature, is often neglected or but ineffectually performed. Its importance in the production of first class leaf, however, cannot be over-emphasized. Some amateur growers even contemplate curing sucker leaves and endeavouring to market them. This practice cannot fail to reflect discredit on such growers. Sucker leaves will not mature, and the labour involved in picking and trying to cure them is never warranted.

Suckers will reappear from three to four times during the one season, and each successive crop must be removed. They should not be allowed to reach a greater length than 3 inches. Beyond this stage, the stalks become tough and woody. and are difficult to remove without completely breaking the leaf from the main stalk, or damaging and bruising the web. The main stalk is supported just below the leaf junction with the fingers of the hand, while the sucker is broken off by a downward and sideward pressure of the thumb. In the first suckering, it is probable that every leaf will have to be treated, but in subsequent operations the number of suckers per plant probably will be greatly reduced.

Suckering should be persisted with until the last leaves have been harvested. One man can expect to sucker half an acre per day at the first suckering. The operator will suffer less fatigue if he works from the bottom of the plant upwards, and will suffer less physical discomfort if he removes the hairs from his arm. This will prevent the dragging caused by the contact between the gum on the leaves and the hair of the operator's arms.

Seasonal Note.

Where a grower wishes to experiment with a number of different varieties, these should be restricted to a small area regarded as an experimental block. The bulk of his plantation should be confined to one or two main sorts, as a great number of varieties, none of which occupy sufficient area to completely fill the kiln at one picking increase curing difficulties by the variation in varietal characteristics.

Blue Mould in Tobacco

(*Continued from page* 471.)

water. Bluestone should be dissolved in a wooden vessel or enamelled container, and not in tin or iron vessels. It is most convenient to prepare the bluestone solution a day before it is required for use. After solution, each gallon of the stock solution will contain 1 lb. of bluestone.

The quicklime, which must be fresh, a fact which is shown by its occurrence in lumps, is slaked in a separate vessel. The best way to ensure freshness where small quantities of lime are required to buy it in sealed tins, which contain about 40 lb. of quicklime. When not in use, keep the tin sealed. The amount of quicklime should be carefully weighed out, placed in a suitable vessel, and slaked by the addition of a small quantity of water. Do not add so much water to drown the lime. After a while, chemical action takes place, the lumps swell and break down to a fine hot powder. Add more water, and stir with a stick to make a milk-like paste. To illustrate the further steps necessary in the preparation of Bordeaux, consider making up 40 gallons of a standard 1 per cent. Bordeaux. To prepare a 1 per cent. Bordeaux mixture, the formula is:—

Bluestone—4 lb.
Quicklime—4 lb.
Water—40 gallons.

Four gallons of the stock bluestone solution are taken, and added to 16 gallons of water, which have already been carefully measured out into a wooden vessel. A suspension of 4 lb. of quicklime slaked in 1 gallon of water in the way described earlier is added to 19 gallons of water placed in a second barrel. Each barrel thus contains 20 gallons of solution, which are then poured together into a third barrel, or the tank of the spray pump, and, after stirring, the Bordeaux mixture is ready for use. The simultaneous pouring of these solutions can be made easier by equipping each barrel with a tap and small piece of hose. It is necessary to emphasize the necessity for accurately measuring all quantities, and ensuring that only fresh and active quicklime is used.

In recent years, there has been considerable complaint about the occurrence of "blue mould" in the field. In the cases that we have been able to investigate in some detail there has been good reason to believe that the bulk of infection actually originated in the seed-bed, although plants may not have shown symptoms of disease at transplanting. The importance of thorough control in the seed-bed is emphasized in the belief that if this is effected, occurrence of the disease in the field will be negligible, and will not call for special control measures.

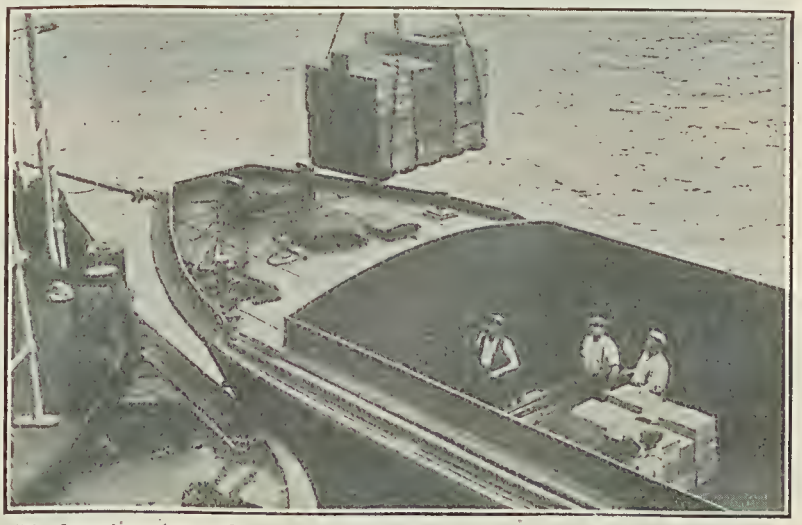
Overseas Fruit Markets

Requirements Analysed

By E. Meeking, Senior Fruit Inspector.

In the following extracts from his report which was made after a private trip to Great Britain, Germany, and America, Mr. Meeking outlines some of the faults that require to be remedied if Australian fruit is to bring the highest possible returns on the overseas fruit markets.

THE writer's first inspection of Australian fruit on overseas markets was made at Hamburg in May, 1930, when the opportunity was taken to inspect a shipment of 32,511 boxes of apples *ex* s.s. *Tekoa*. At Hamburg fruit is sold by auction, and the day before sale sample boxes promiscuously selected are opened and placed on benches for inspection. As a large percentage of the total in each line is exhibited, a decidedly representative sample is obtained. Consignments to each agent are kept separately, and the buyers provided with catalogues inspect the fruit and mark catalogues with the price which they consider they should offer at the sale. This, of course, is determined by the condition of the fruit. Prior to viewing this shipment, I had been shown a line of about 12,000 boxes of American Winesaps exhibited in an adjoining shed, and which was to be sold on the same day as the Australian fruit *ex Tekoa*.



Discharging Australian fruit at the fresh fruit wharf, London Bridge.

I was struck by the wonderful uniformity of boxes and labelling, colour, and size of this American fruit, and the tightness of pack—the latter indicated by the pronounced "bulge" of the fruit in each box. The sizes of the fruit ranged from 125 (2¾ inches) to 173 (2¼ inches), and every box containing fruit of a particular size was an exact replica of every other box containing fruit of a similar size. Although, having been harvested in November, 1929—it had been cool stored for six months—it was in excellent condition. The line was branded "Extra Fancy," meaning that it had been prepared in accordance with the requirements for the highest standard, and its preparation (packing, boxes, labelling, &c.), bespoke standardized methods, applied to a very high degree.

On seeing the long rows of boxes of Australian fruit, with the wrappers removed from the top layers of fruit, the first impression was the extremely "ragged" or piebald appearance of each box, and of the exhibit as a whole, picturing a lamentable lack of "finish," in direct contradistinction to the display of American fruit in the adjoining shed.

This was caused mainly through extreme differences in colour of the fruit, which, in each box, ranged from light and dark green to light and dark red; but spray russetting, irregularity in sizes of fruit, differences in

Victorian fruit at the Royal Albert Docks, London.

types, sizes, and colours of boxes, and variations in the marking and labelling, together with a multiplicity of growers' and exporters' brands, contributed largely to the unsatisfactory general effect. Slackness of fruit in boxes was also very noticeable. A large percentage of the Jonathans were of nondescript appearance. This variety lacked characteristic colour, even in the fairly matured fruit, and in shape and other respects was not true to type. These peculiarities were observed not only in the *Tekoa* shipment, but in the Jonathans examined at all places which were visited throughout the season. All the drawbacks mentioned, combined to form a display which one could not help thinking must have confused buyers and sellers alike, making it extremely difficult to assess the true market value of most of the lines displayed. Subsequent inquiries from leading merchants and brokers confirmed this.

Increasing Competition.

Briefly, at every place visited—London, Hamburg, Glasgow, Manchester, and Liverpool, merchants and brokers spoke very unfavorably on the great want of uniformity in the Australian pack. All agreed that improved methods would need to be adopted, if we wished to realize full market values for our fruit. They considered that with the present acute competition coming from New Zealand, South Africa, and (quite recently) Chili, to say nothing of the competition of American and Canadian cool-stored apples, if Australian fruit-growers did not at once alter their methods of preparing fruit for oversea markets, not only would expansion of trade be impossible, but the trade now existing would be endangered.

Unfortunately, a fresh competitor is likely to appear on the Western European markets, as the writer saw some thousands of boxes of Russian apples in one of the exhibition sheds at Hamburg. Although this fruit was very crudely packed in large double boxes, and contained such a large proportion of bruised specimens that there was little demand by purchasers, the merchants thought it would have some effect in lowering the price of fruit from other countries, as it had been dumped in Hamburg for what it would bring.

The 1930 season was the first season that Russia sent fruit to Hamburg, and the merchants view the matter very seriously, as with low production costs Russia can afford to sell her produce throughout Western Europe at prices against which it would be impossible to compete. They thought Russia would soon improve her methods of packing, and might become a serious competitor to other apple-growing countries. The Hamburg market offers unlimited development, being the largest distributing centre, not only for Germany, but to Holland, Belgium, Denmark, and Scandinavia, but to obtain best results no apples under $2\frac{1}{2}$ inches should be sent, as small apples are not favoured on this market.

Hardwood v. Softwood Containers.

At Glasgow, consignments *ex.* s.s. *Asphalion* and *Esperance Bay* were examined. Excepting that extreme variability in colour of fruit was not so noticeable in these shipments as in the *Tekoa* shipment, all the other defects regarding boxes and slackness of pack were apparent. At every place visited, merchants, brokers, and all concerned, spoke very unfavorably on the differences in boxes used in the Australian trade, and pointed out that no other fruit exporting country carried out its business on similar lines. With the exception of two

merchants who appeared indifferent, all those interviewed strongly favoured the Canadian standard box as being the box most suitable for packing, but all agreed without exception that one type of box only should be used for apples; and that unseasoned, stained, or warped cases undoubtedly affected the market value of the fruit; so that if Australian fruit-growers decided to use Australian hardwood boxes only, these would need to be better dressed and seasoned than at present.

Auction Room, London Fruit Exchange.

Merchants complained of irregularity in shipments. They stated that at present Glasgow can absorb about 130,000 boxes per season. These should be sent in about five shipments arranged over, say, ten weeks, or an average of 13,000 boxes per week. At present, systematic direct shipments would be hard to arrange, but as Glasgow has a very complete rail service with London, Liverpool, and Hull, supplies could be regulated by rail through these ports. The rail freight averages about 1s. per box, and the British railway companies have sufficient "pipe" vans which may be attached to passenger trains to ensure rapid and cool transit.

Glasgow wants large-sized apples only. Apples from 138 to 175 per box should be sent with no fruit under 2½ inches, or, if this is not possible, 20 per cent. (not more) of total shipments may be sent down to 2½ inches. The principle of shipping apples of sizes to suit the tastes of consumers at each port should be strictly adhered to.

At Manchester a shipment of 32,936 boxes of apples *ex* s.s. *Berwickshire* was examined at one of the many excellent sheds adjacent to the docks. This shipment showed a marked improvement over those seen at Hamburg and Glasgow, but slackness of pack and irregularities in type and appearance of boxes were still noticeable. Many Jonathans, instead of being immature, as was the case at Hamburg, had gone to the other extreme, and appeared overmature, some showing signs of incipient internal breakdown.

Several visits at different periods of the season were made to Covent Garden, The London Fruit Exchange, Spitalfields, and other markets. In addition to the other defects mentioned in this report, consignments were often practically valueless through internal breakdown and bitter pit. It is understood that this is probably caused through want of precooling, the shipment of immature fruit, careless picking, packing, and handling, or the close stowage of fruit in sheds prior to shipment.

Too Many Varieties.

A total of 65 varieties of apples and 22 varieties of pears were shipped from Victoria during the 1930 season. A few varieties—Dunn's Seedling (sy. Munro's Favorite), Granny Smith, Cox's Orange Pippin, and Cleopatra, bring such pronouncedly superior prices that their retention as export varieties is placed beyond doubt. Regarding many other varieties, the list is far too long, and a complete review should be made of the average prices received throughout the season, and also the condition in which each variety landed. Definite evidence would then be obtained of the most profitable varieties to ship, and compulsory or voluntary action could be taken to prevent shipment of unprofitable varieties. A basis would also be established for working the approved varieties over those which had proved unsuitable. The Pacific States and Western Canada have already taken action in this matter, and I was informed that in one of the largest apple-growing districts over 96 per cent. of the total grown now consists of only half a dozen proved varieties.

Arriving at the London Fruit Exchange.

Irregular Supplies.

Merchants in the United Kingdom complain of the irregularity of supplies during the currency of each season. This is mainly caused by the irregular arrival of boats and discrepancies in the quantities they carry. One week four or five large steamers may discharge heavy cargoes in London, and two or more steamers unload large shipments at, say, Liverpool and Hull. Next week two or three boats with medium or light cargoes may discharge in London only. To a large extent it should be possible to avoid this by forming a freight committee in Australia, which, in conjunction with the Overseas Shipping Representatives' Association, should be able to arrange a more orderly programme of sailings and quantities. If possible, this committee should co-ordinate with the Export Control Board of New Zealand in arranging a mutual programme.

Marketing Methods in United Kingdom.

The wholesale marketing of fruit in the United Kingdom is carried out mainly under two separate and distinct methods: (1) Private treaty, and (2) auction. The leading firms operating under these two methods are comprised of individuals of high repute and status, both in commercial and social circles.

In the course of conversation the merchants of each section claimed advantages for the system under which their particular business functioned; but, as I know of no comprehensive extended analysis having been made of prices realized under the two methods, comment would be invidious.

The chief requirements for success in any business are established sound repute, financial stability, and wide clientele.

Firms with these will usually obtain high average prices throughout each season, as the resources they command give them wide opportunity to withstand, or at least, minimize the effects of fluctuating markets and irregular supplies.

"Limited sellers, unlimited buyers," should be adopted as a slogan by those who grow and ship fruit for sale overseas. From what I gathered, competition amongst sellers does not appear to produce a corresponding competition amongst buyers, but rather the reverse. When a buyer knows that if one seller's prices do not suit, he may run elsewhere in the hope (often fulfilled) of buying cheaper, he naturally will not offer as much as he would if his choice were restricted.

I believe that Australian fruit-growing interests could be more adequately safeguarded abroad than at present by the formation in the United Kingdom of a committee or council to stabilize or, at least, minimize the disastrous competitive effects of irregular supplies, not only from Australia, New Zealand, and South Africa, but also from the United States of America, and Canada *ex* cool storage. This committee might also be given authority to act in collaboration with this side on matters of broad policy, such as freight and transport matters, preference, legislative enactments, &c. Affiliation with the International Apple Association and a liaison with the Empire Marketing Board would be a natural corollary.

Complementary to the functions of the council, the establishment of a supervisory, intelligence, information or commercial agency (or whatever it may be termed) is worthy of earnest consideration. Some of the possible activities of this agency are suggested. They would consist in keeping tag on fruit movements on arrival, both before and after wholesale disposal; to send its officer or officers around the United Kingdom and continent, and by inquiries from retailers ascertain if

our fruit is obtaining the highest possible retail distribution, or whether through shortage or irregularities of supplies, insufficient advertising, supply of varieties and sizes of apples or pears unsuitable to the tastes of the various localities; or the delivery of fruit in unsound condition, the retail markets are insufficiently penetrated. This agency could also collect all published data relating to storage transport and other problems and direct its distribution to those most deeply concerned.

Grade Marks and Certificates.

At every place visited in the United Kingdom and Germany, I was told that, although fruit from the Pacific States and Western Canada was sold on grade marks shown on boxes, in conjunction with official certificates which were issued, the trade paid little or no regard to the grade branding on boxes of Australian fruit or to Government certificates, as these gave little or no indication of the market value of the fruit, even when this was packed up to the full requirements of the regulations.

These remarks do not apply with full force to the "Special" grade, because it embraces colour requirements which, though indefinite, give some indication of the maturity stage at which the fruit has been packed. Of the total of 877,469 boxes of apples shipped from Victoria, 790,549 boxes were exported under Standard grade brand, and 86,920 boxes under Plain grade brand. Therefore, no fruit was shipped from Victoria under Special grade.

No colour requirements are included in the "Standard" and "Plain" grades, and as little or no fruit was shipped under "Special" grade brand none was packed with any regard to colour requirements; and, moreover, as no maturity requirements were included in any grade, none of the fruit was packed with regard to the important matter of its maturity.

An analysis of the requirements in the Standard and Plain grades will show that in the matter of segregating apples in accordance with their market value, these grades are practically useless.

Too much consideration has been given to fixing the two lower grades from the view-point of the presence and extent of disease with which the fruit is affected, and not enough regard has been paid to the colour and maturity stand-points. The net result has produced one grade which, if strictly adhered to by growers and packers, is of practically no commercial value on the overseas markets; and another grade which, through the absence of colour and maturity requirements, produces when displayed for sale overseas, the hotch potch show mentioned in this report in connexion with the *Tekoa* shipment, and which consisted of an indiscriminate mixture varying in shades of colour and degree of maturity.

In the Pacific States and Western Canada the growers' organizations and up-to-date individual shippers have their own grade standards, which are higher than the legal standards. In Canada all fruit must be inspected under the provisions of the Fruit Act, and fruit is inspected in packing houses or may be inspected at any point in transit. Inspectors may prosecute for infringements. The whole aim at the back of this method was to place the fruit on the market as nearly as possible in the same condition and with the same appearance as when it was harvested. The fact that commercial transactions are carried out on the basis of the grade marks on boxes and the particulars shown on Government certificates is eloquent evidence of the large measure of success which has been attained.

If Australian fruit-growers consistently packed to the requirements of the Commerce Act regulations the pack, although not a pack of high commercial value in many instances would be better in appearance. Unfortunately, a number of consignments containing fruit below the requirements of the regulations is shipped. Fruit-growers in certain States are worse offenders in this regard than growers in other States; and under the conditions in which inspectors are compelled to carry out their duties, anything approaching 100 per cent. detection of these infringements is quite impossible.

The foregoing remarks may be construed as an indication that the Commonwealth and State authorities have done little or nothing to inform fruit-growers on the necessity for adopting some form of collective control, and all that this connotes, on the lines through which the fruit-growing industry has been developed in the Pacific States and Western Canada. This is not so, as attempts have been made during the past twenty years in Victoria, at any rate, to induce fruit-growers to adopt American and Canadian methods for packing and marketing their fruit.

Packing Methods in California.

For the purpose of seeing fruit packed under organized direction, the writer returned through the United States of America, via

California, Oregon, and Washington. At Los Angeles two packing houses were visited. One was devoted to the packing of lemons; the other to the packing of oranges. The equipment of these packing houses was far more complete than any the writer has seen in Australia. Every operation, except grading for colour and general quality, and packing the fruit into the boxes, was carried out by machinery, which size-graded, washed and polished the fruit, and labelled, pressed, nailed, and strapped the boxes. Grading the fruit for colour and general quality was performed by girls who selected the fruit as it travelled before them on broad leather belts and packed it into different boxes according to its colour and general quality. The boxes when packed showed a "bulge" of at least 2 inches.

To one accustomed to seeing fruit packed in Australia, the boxes seemed abnormally full; but after watching them pass through the pressing, nailing, and strapping machines, one realized that this method of filling and pressing the boxes was one reason why American consignments showed such small proportion of "slack" boxes when offered for sale on the European markets. Packing houses in Oregon and Washington were also visited. In these the methods of packing apples and pears were similar to those in vogue in California.

It is probable that climatic conditions and the use of cool storage, in combination with the use of insulated railway cars, provided another reason for the tightness of the American pack as against the slackness of the Australian pack, when offered for sale on overseas markets, and which, as mentioned in this report, was so apparent at Hamburg. During a large part of the apple harvesting and shipping season the ordinary atmospheric temperature is low enough to avoid the necessity for obtaining low storage temperature by artificial means. I understand, in fact, that it is frequently necessary to employ artificial means to prevent the inside temperature of stores and cars from falling low enough to freeze the fruit.

If Australian apples were carefully harvested, packed, and transported, to avoid rupture of skin and tissues, and were carefully selected for uniformity in colour and in a stage of maturity which was sufficiently advanced to ensure a continuation of the ripening processes; and, finally, were precooled to a sufficiently low temperature to ensure that the machinery on the transporting ship would be enabled to maintain a uniform temperature in the hold and in the fruit itself within range of a few degrees around 32 deg. or 33 deg. Fahr. I believe that most of the causes for complaints now so frequently heard from overseas regarding the appearance and condition of the fruit would be removed.

This statement is made advisedly, even although it is open to criticism, in view of the fact that it has never been proved by a commercial shipment of apples forwarded under the conditions mentioned, particularly that which relates to the pre-cooling of fruit.

In reply to such criticism, I would point out that much of the research work which has been undertaken in connexion with cold storage and transport of fruit has produced strong theoretical evidence that pre-cooling of fruit before stowage in ship's holds is necessary for the establishment and maintenance within the lowest possible limit of a uniform optimum temperature throughout the hold and the fruit itself.

It is considered that the deficiencies in the Australian pack result from fundamental causes, which cannot be removed unless the Australian fruit-growers develop a different outlook, and cultivate a wider sense of service such as appears to have developed amongst the fruit-growers on the Pacific slope of North America and in New Zealand and South Africa. The excellent appearance of the pack from those countries is merely a reflex of this development, as conversely the irregularity of the Australian pack indicates its absence.

It is, unfortunately, no exaggeration to say that the Australian pack, particularly the pack from the Eastern States of Australia, displays more irregularities and less finish than that from Western Canada, South Africa, New Zealand, the Pacific States, Chili, or Brazil, from which last-named country the writer saw oranges excellently packed in most attractive boxes, although this is the second season only that Brazil has shipped oranges to the United Kingdom.

The efficient operation of all the new activities suggested in this report, and which refer to improved and more orderly methods of transporting, marketing, and distributing our fruits depends entirely upon the production of a pack which will commend itself to the purchaser, and which will hold its own against competition.

The benefits to be derived from the formation of a freight committee in Australia and a stabilization council in London, together with

the other suggestions given, would be largely stultified if the present disorganized and haphazard methods under which our fruits are prepared for market are allowed to continue. Permanent success in salesmanship of any article, manufactured or raw, depends entirely upon demand. This demand is largely determined by price and quality, as if these do not suit the purchaser, he will give no repeat orders. The fruit-growers of this country cannot control the price which the purchaser is prepared to pay, but the matter of quality production rests entirely with themselves.

SUMMARY.

A brief summary of the requirements which have been suggested in this report, to maintain and develop our export trade in apples and pears to the overseas markets, and to place the interstate and local trade in these fruits on a sound basis may be stated as follows:—

1. The gradual elimination of many of the varieties now grown and the cultivation of long lines of a few varieties outstanding in uniformity of colour (red, yellow, and green), and long cool storage qualities.

2. Careful selection of fruit when picking to obtain, as far as possible, absence of bruised or punctured fruit and uniformity in colour and degree of maturity.

3. Elimination of many of the various sized boxes whose use is now permitted, for packing apples, with the exception of the softwood type of box having inside dimensions 18 inches long by 10½ inches deep and 11½ inches wide. For packing pears the use of the box, which is included in the Victorian Fruit and Vegetable Act Regulations, and which measures inside 18 inches long by 11½ inches wide, and depth optional, and cut to suit the size of the contained fruit.

4. The packing of fruit by number instead of by weight and diameter of the fruit.

5. Correct methods of grading and packing, including grading for uniformity of colour as well as sizes of fruit, the washing of fruit before packing, and the final pressing and nailing of boxes by mechanical means.

6. Collective purchase of all orchard and packing shed requisites and collective action, as far as possible, in carrying out orchard, packing, and transport practices to reduce production, transport, and marketing risks with resultant losses and costs to a minimum.

7. Pre-cooling of fruit as soon as possible after picking and packing to prevent or minimize many transit troubles, such as loss of moisture, and consequent shrinkage of fruit; the occurrence of internal breakdown and other forms of wastage which probably are often induced by the self-heating of fruit when stowed in railway trucks, wharf sheds, and ship's holds without pre-cooling.

8. A systematic continuation of the investigations which have been made both in England and Australia in connexion with storage and transport problems, embracing all factors from plantation to consumer, and the circulation of the results of these investigations amongst growers and exporters.

9. The formation of a council in the United Kingdom, consisting of those interested in the development of Australian fruit marketing, to act in collaboration with fruit-growing interests in this country on all matters of broad policy, e.g., preferential trade, &c.

10. The linking up of Australian exporters with the International Apple Association for the purpose of obtaining reliable statistics of crop forecasts and for other purposes connected with broad policy.

11. The establishment of a liaison agency in the United Kingdom, to act in conjunction with the council and to attend to many matters mentioned in this report, which would lie outside the scope of the council's functions.

12. The establishment of research orchards for carrying out research work on lines similar to those in vogue at East Malling, Kent, and Long Ashton, Bristol. It is submitted that at least two such orchards under the direct control of the Department of Agriculture are urgently required in Victoria.

13. Any future plantings of apples and pears in isolated localities to be discouraged, and intending growers induced to plant in districts where orchards have already been established.

NOTE.—Some of the suggestions and recommendations outlined in this report are included in a circular folder issued to the trade by Mr. H. G. Colombie, president of the Victoria Fruit Marketing Association, on his return from abroad, and others are included in the third report—Fruit—of the Imperial Economic Committee issued in 1926, as shown by the extracts quoted. Mr. Colombie and I, however, arrived at our conclusions quite independently, and I had not read the report of the Imperial Economic Committee until the outline of my report had been drafted, and after my return from overseas.

The writer wishes to thank all who assisted him in his inquiries; also Mr. Colombie, who supplied the photographs from which the illustrations were made.

Potato Experiments

Results of Tests, 1930-31

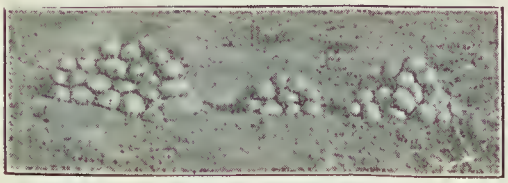
By J. T. Ramsay, Potato Expert.

INTERESTING results were obtained this year from the potato test plots at Millbrook. At these plots, which are located on a red volcanic loam on the farm of Mr. P. J. Ryan, the experimental work is much more comprehensive than is the case on other plots conducted by the Department of Agriculture in the various potato-growing districts. The past season at Millbrook was not one favorable to the growth of the potato crop. The rainfall was erratic and too light during the period when the crop was most likely to benefit from good rains. In addition, the crop received, in February, a severe check, caused by fairly sharp frosts, which, though not severe enough to kill the plants, were sufficiently heavy to effect an appreciable reduction in the yield. The rainfall at Millbrook for the six months October, 1930, to March, 1931, was as follows:—

October, 1930	..	262 points
November, 1930	..	68 ,,
December, 1930	..	443 ,,
January, 1931	..	106 ,,
February, 1931	..	40 ,,
March, 1931	..	247 ,,
Total	..	1,166 points

Despite the adverse climatic conditions, the comparative yields from varying treatments—manurial and otherwise—show considerable differences, all of which are in favour of the several practices which have been advocated from time to time by this Department. These practices have been recommended only after extensive trials—trials which have been conducted under widely varying seasonal and soil conditions.

Yields in the manurial trials were very light; indeed, the Millbrook plots this year gave the lowest average yield of any in the State. The outstanding feature of the manurial trials is the consistently good returns given by the "3 and 1" dressing, that is, 3 cwt. super. and 1 cwt. ammonium sulphate per acre. Since this combination was introduced into the manurial variations applied to the volcanic soils, it has given each year results superior to those of any other manure or combination of manures. Exceptionally high percentage increases over the unmanured plots were recorded this year. The unmanured plot gave a yield of only 16½ cwt. per acre, this low return being accounted for by the poor start obtained by this plot and the inability of the crop to recover from the February frosts. The weights recorded are for market-sized tubers only. In Table I. individual weights of marketable tubers harvested from each plot are shown. The increases in yields are recorded in weights and percentages. At these plots, as at all others except Warragul, the addition of potash to the super. and ammonia is not followed by any increase in yield. On the contrary, there is an actual decrease—a fact for which no adequate explanation is, as yet, available. One suggestion made is that the potash possibly had an injurious effect on the sprouts of the tubers. This, however, is not noticeable in the appearance of the plants in the early stages of growth, though possibly some difference might exist without being marked enough for observation. This effect of potash is rather remarkable in the light of the fact that potassic manuring is a regular and advocated practice in manuring for potatoes in Europe. It is proposed to carry out laboratory tests to discover, if possible, an explanation of the effect, or lack of effect, of potash on potatoes.



Yields from one row—left, 3 cwt. super. and 1 cwt. ammon. sulph.; centre, unmanured; and right, 3 cwt. super.

Because of low prices which have prevailed for some time, the financial benefits from manuring this year is not so marked as has been the case in former seasons. However, a profit is shown in each case, while, in addition, the land has been kept in heart instead of being depleted, to some extent, of its fertility.

TABLE I.—POTATO MANURIAL TRIALS—MILLBROOK, 1930-31.

—	Yield of Marketable Tubers.	Increase due to Manures.	Percentage Increase.
	T. C. Q.	T. C. Q.	%
2 cwt. super. ..	1 5 0	0 8 2	50
3 cwt. super. ..	1 15 0	0 18 2	115
4 cwt. super. ..	1 18 3	1 2 1	137
No manure	0 16 2	..	..
3 cwt. super., 1 cwt. sulph. ammon. ..	2 10 0	1 13 2	203
3 cwt. super., 1 cwt. each sulph. ammon. and pot. sulph. ..	2 4 1	1 7 3	173
3 cwt. market garden manure	1 18 3	1 2 1	137
3 cwt. basic phosphate	2 4 0	1 7 2	172

The above applications of fertilizers have been in use at Millbrook for the last four years, and it is possible now to determine the most profitable manure or combination of manures over that period. Prior to 1927-28, alterations in the manurial applications were made from season to season, and much heavier quantities of super. were applied. Sufficient evidence was obtained then to indicate that heavy rates of application of the super. were in excess of what the crop could profitably utilize in this district. Consequently, these were reduced to variations of 2 cwt., 3 cwt., and 4 cwt. per acre respectively. For combined dressings the super. rating of 3 cwt. was taken. The results of the past four years amply justify this alteration. While the results obtained have not been without fluctuation from year to year, there has been a satisfactory degree of consistency. So far as the phosphate dressing is concerned, 3 cwt. seems to be the optimum rate for Millbrook soils, while the combination of 3 cwt. super. and 1 cwt. ammonium sulphate per acre is pronouncedly the most beneficial and profitable that has been arrived at so far. The percentage increases are interesting in their variation. The "3 and 1" mixture has given an average increase of 94 per cent. for each of the four seasons mentioned. This is a very high rate of increase, especially on red volcanic soil, which it naturally rich and recognized to be only grudgingly responsive to manurial treatment.

In the four years' average we again find the curious reduction where potash was applied (3-1-1), the reduction being constant in three out of the four years under consideration. These averages are set out in Table II.

Amongst the various rates of super. that of 3 cwt. per acre shows to the best advantage. The addition of another 1 cwt. per acre, making a total of 4 cwt. per acre, gave no further increase in yield. Actually, over the four years' period the average yield for the heavier dressing is slightly lower than with the application of 3 cwt. per acre.

It is difficult to arrive at a true average of prices for a period of years, as it is impossible to obtain figures as to the actual quantities sold at various prices. However, £6 per ton, I think, could be taken as a reasonable average price for the past four years. Applied to the Millbrook results, that value shows an increased return in favour of the "3 and 1" dressing of approximately £12 per acre over the four-year period. I estimate that, on

TABLE II.—MANURIAL TRIALS, MILLBROOK.—YIELDS FOR FOUR YEARS 1927-28 TO 1930-31.

Treatment per Acre—	2 cwt. Super.	3 cwt. Super.	4 cwt. Super.	No Manure.	3 cwt. Super. + 1 cwt. Am. Sulph.	3 cwt. Super. +1 cwt. Am. Sulph., 1 cwt. Pot. Sulph.	3 cwt. Market Garden Manure.	3 cwt. Basic Phosphate.
	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.
1927–28	4 13 3	5 12 2	5 10 0	3 15 0	7 2 0	6 0 2	4 5 3	4 0 1
1928–29	1 5 2	1 13 2	1 8 0	1 1 1	1 12 0	1 12 0	1 8 0	1 4 0
1929–30	4 11 1	5 0 0	4 8 1	2 19 0	5 9 0	5 0 0	5 0 0	3 16 2
1930–31	1 5 0	1 15 0	1 18 3	0 16 2	2 10 0	2 4 1	1 18 3	2 4 0
Average (4 years) ..	**2 18 3**	**3 10 1**	**3 6 1**	**2 2 3**	**4 3 1**	**3 14 0**	**3 3 0**	**2 16 0**
Average Percentage Increase	**37%**	**64%**	**54%**	**..**	**94%**	**72%**	**46%**	**30%**

Perfect specimens of Earliest of All—grown at Childers, Vic.

the average soil devoted to potato cultivation in Victoria, it costs about £14 to £15 per acre to bring the crop up to the point of digging. Costs after that are, of course, contingent on the yield, labour charges, and cost of bags and marketing. In any case the average increased return of £12 per acre from the application of the "3 and 1" dressing would meet the bulk of the cost of growing the crop on this class of soil. In these times every effort must be made to lower production costs, and judicious manuring is one of the most certain means of lowering costs. It should be practised, therefore, by growers even on apparently rich and high-priced soil.

Variety Trials.

In the variety trials, the best return was given by the late Carman variety grown from selected Beech Forest seed, which yielded 6 ton 7 cwt. per acre of market-sized tubers. This should provide a convincing answer to those who contend that this variety is running out. Reference to Table III. will show a very wide range in the production for the past season of the different varieties grown at Millbrook, the range being from 22 cwt. per acre to 6 ton 7 cwt. of marketable tubers. It will be seen that the proportion of small tubers is very high—in the case of Beauty of Hebron it actually reached 50 per cent.—an abnormal percentage. This can be accounted for by the damage from the February frosts, which did the greatest damage to those varieties which tuber early during the growing period.

The average production per acre for the market-sized tubers of all varieties tried this season was 3 tons 8 cwt. 3 qr., and the gross weight 4 tons 4 cwt. 3 qr., showing a light average and a high percentage of small-sized tubers throughout.

Attention is drawn to the effect of selection on the proportion of market-sized tubers to small chats. The selected Beech Forest late Carman, in addition to giving the heaviest yield of market-sized potatoes gave also the lowest proportion of non-marketable sizes. In the case cited there were only 7 cwt. of small tubers to a weight of 6 tons 7 cwt. 1 qr. per acre of market size. This is approximately equal to one bag in eighteen.

Results of variety trials are set out in Table III. Each of the plots in these trials was manured with super. at the rate of 3 cwt. per acre.

Table III.—Variety Tests, Millbrook.

Variety.	Marketable.			Small.			Total.		
	T.	C.	Q.	T.	C.	Q.	T.	C.	Q.
Carman I. (virus infected)	1	2	0	0	16	2	1	18	2
Carman I. (Romsey) ..	4	3	0	0	16	2	4	19	2
Earliest of All ..	4	14	0	0	11	0	5	5	0
Beauty of Hebron ..	1	2	0	1	2	0	2	4	0
Scottish Triumph ..	6	1	3	0	13	3	6	15	2
American Rose ..	3	17	2	0	16	2	4	14	0
Late Manistee ..	4	8	2	0	13	3	5	2	1
Carman 3 (Beech Forest, selected)	6	7	1	0	7	0	6	14	1
Excelsior	1	18	3	0	19	1	2	18	0
Brown's River ..	2	4	1	1	5	0	3	9	1
Manhattan	3	17	2	1	2	0	4	19	2
Brownell's Beauty ..	1	18	3	1	2	0	3	0	3
Late Hebron ..	2	4	1	0	19	1	3	3	2
Great Scott	3	3	2	0	11	0	3	14	2
Carman 3 (Beech Forest)	5	0	0	0	8	1	5	8	1
Plunkett	2	10	0	0	13	3	3	3	3
Up to Date	3	17	2	1	15	0	4	12	2

Immature Seed.

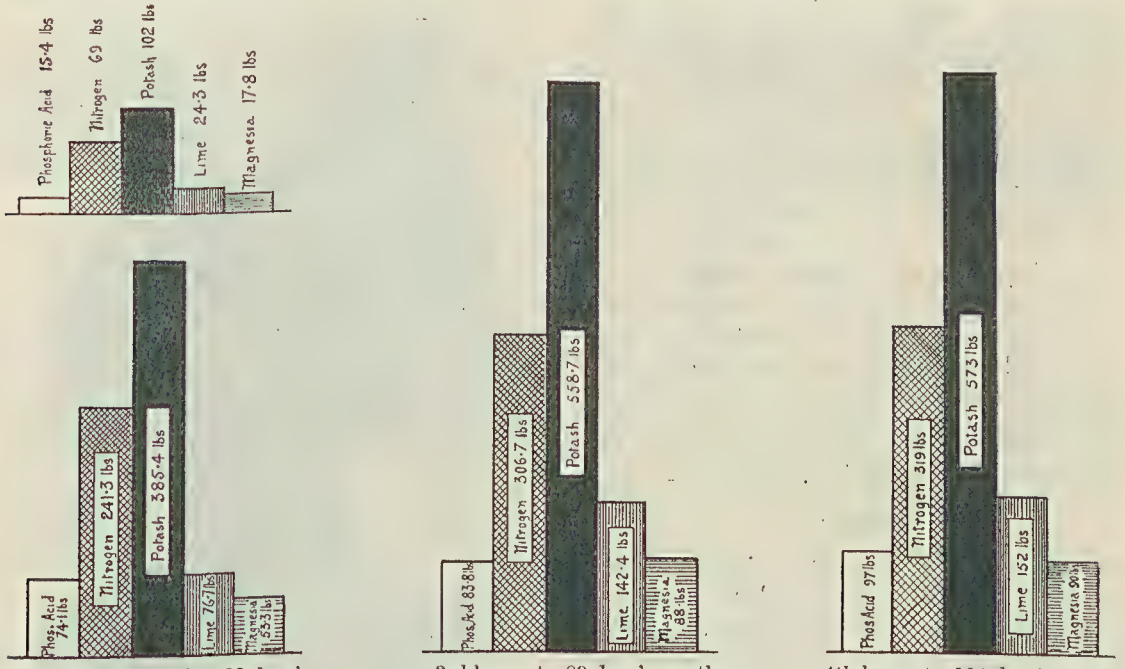
In the tests of immature seed against ripe seed, the results are again very striking. The variety tested was Carman 3, taken without any selection from the run of the previous season's crop grown at Millbrook. The results are shown in Table IV.

TABLE IV.—IMMATURE VERSUS RIPE SEED, MILLBROOK, 1930-31.

	T.	C.	Q.	
Immature seed	4	6	1	
Ripe seed	2	8	3	
Increase from immature seed	0	17	2	= 35%

The superiority of immature seed is beyond question. That superiority has been demonstrated time and time again, and it it so completely recognized in certain countries where potato growing is a specialized industry that growers there make a practice of securing each year sufficient immature seed for their requirements. The correct stage at which to harvest for seed is when the first indication of yellowing from ripening is shown in the leaves. Care must be taken to differentiate between the yellowing of the leaves due to ripening and that due to disease. If the seed be harvested at the stage described, the degree of immaturity necessary for the greatest vigour in the seed will be secured without sacrificing too much in yield. Numerous attempts have been made to determine the reason for the superiority of immature as against ripe seed from the same crop, but so far no definite explanation has been obtained.

During the season 1916-17 a comprehensive laboratory test was carried out by this Department in an endeavour to determine, among other things, the reason for the higher efficiency of immature seed. Complete analyses of the whole potato plant were made at four stages of growth. These four stages were—(*a*) at one month from planting, (*b*) at two months, (*c*) at three months, and (*d*) at four months—the plants being thoroughly matured at the fourth and final harvesting. It was anticipated that chemical analyses would show some variation in the constituents of the plants at the varying stages of growth, but that was not the case, the various analyses giving practically identical results. However, some valuable information was gained as the rate at which the potato plant assimilated its plant food from the soil throughout the period of maturation was determined. The evidence showed very clearly that this assimilation of



Top. 1st harvest after 33 days' growth.
Bottom. 2nd harvest—58 days' growth.

3rd harvest—89 days' growth.

4th harvest—124 days' growth.

Composition of Potato Plant.

1st and 2nd Harvests.

plant food takes place very much more rapidly during the first two and a half months of growth, and becomes progressively slower in the later period. The graphs illustrated show this very definitely.

The accompanying photographs of the plants, which were grown in synthetic soil and analysed, show the four stages at which they were harvested.

Diseased v. *Clean Seed.*

Another interesting trial at Millbrook last season was that between diseased and clean seed. The diseased seed was taken from plants affected with virus, and was given the same soil and cultural treatment as the clean seed. The variety used was Carmen III. The results are shown in Table V.

Table V.

Healthy Seed.	Diseased Seed.
T. C. Q.	T. C. Q.
4 3 0	1 2 0

The improvement in yield in favour of the clean seed was 3 ton 1 cwt. per acre, or 327 per cent. This is a striking illustration of how a crop may be handicapped by the use of inferior disease-affected seed. A good start is half the battle, but where diseased seed is sown there is no chance of the crop getting that good start.

Left—healthy seed; Right—diseased seed.

In the "selected-seed" test the returns further substantiate the findings of previous years, and this season the very material increase of 27 per cent. was shown. The variety used in this test was late Carman from Beech Forest which had been grown at Millbrook for one year previously.

Table VI.—Selected versus Unselected Seed.

Selected.	Unselected.	Increases from Selection.
T. C. Q.	T. C. Q.	T. C. Q.
6 7 1	5 0 0	1 7 1 = 27%

3rd Harvest.

4th Harvest.

Boxed Seed.

The benefit of correct storage is demonstrated clearly by the result of this year's trial between seed stored in boxes and seed stored in bags. The yields in this test are set out in Table VII.

TABLE VII.

Boxed Seed.	Bagged Seed.
T. C. Q.	T. C. Q.
3 12 0	1 2 2

The increase in favour of the boxed seed was 2 ton 9 cwt. 2 qr. per acre, or 222 per cent.

The need for correct storage of seed potatoes has been very strongly stressed by this Department for many years, and further definite proof of the benefit to be derived from this practice is afforded by these results. The question of seed storage was dealt with fully in an article in the July issue of this *Journal*.

Cultivation Test.

As in previous years, inter-cultivation of the crop when growing proved highly beneficial. This test consisted of dividing the area into three lots and giving them one, two, and three cultivations respectively with the horse hoe. Significant increases were obtained from the extra cultivations, as shown in Table VIII.

TABLE VIII.—INTER-CULTIVATION TEST.

	T. C. Q.	Increase. T. C. Q.
One cultivation ..	2 10 0	—
Two cultivations ..	3 12 0	1 2 0
Three „ ..	4 8 2	1 18 2

The increases due to cultivation are equivalent to 44 per cent. and 77 per cent. for the extra one and two cultivations respectively. In addition to the increased weight of marketable-sized tubers obtained from the extra working, the proportion of small potatoes in the crop was considerably reduced.

To settle the vexed question of the time seed should be cut before being planted, a test was instituted some years ago, and is still continued. The results in every case prove that seed cut and planted as soon afterwards as possible gives a better yield than seed which is not planted for some time after cutting. The figures for the past season amply support this.

TABLE IX.—TIME OF SEED-CUTTING TESTS.

	T. C. Q.	Decrease. %
Cut at planting ..	3 12 0	—
Cut one week ..	2 4 0	39
Cut two weeks ..	0 13 3	80
Cut three weeks ..	0 8 1	88

It will be noted that the reduction in the yield increased with the length of time between the cutting and the planting, and the reduction was very severe.

The results of the replicated manure trials are shown in Table X. These were calculated by Messrs. Forster and Vasey, of Werribee Research Farm, from plot yields recorded by Potato Field Officer Whelan:—

TABLE X.

—	No Manure.	Super. 3 cwt.	Super. 3 cwt., Amm. Sulp. 1 cwt.	Super. 3 cwt., Amm. Sulp. 1 cwt., Pot. Sulp. 1 cwt.	Standard error.
Lbs. per plot	6.1	10.4	18.0	16.0	.32
Cwts. per acre	16.4	27.9	48.0	42.9	.86

For significance, differences in yield between treatments should be at least three times the figures for error shown in the last column of the table. In this case all the figures are significant. It should be noted that the calculations from the replicated test figures confirm those of tables I. and II.

Clydesdale Horse Breeders Club

Tunart Settlers' Successful Innovation

By R. J. de C. Talbot, B.V.Sc., Veterinary Officer

ON the occasion of the visit of the Better Farming Train to Meringur in 1928, a lecture on Draught Horse Breeding was given, and one of the several points stressed was that, if any improvement in the type and conformation of horses in the district was hoped for in the future, this could be best achieved by the settlers breeding their best mares to a Clydesdale stallion of suitable type. It was realized that few of the settlers were in a position to purchase such a horse, and it was suggested, therefore, that a club or association be formed with the object of purchasing a well-bred stallion, preferably one that had proved himself a sure "foal getter," and whose services would be available to members' mares at a low fee.

At the conclusion of the lecture many members of the audience appeared interested, and the desirability of forming such a club was discussed at some length, together with suggested rules and regulations. It was considered that it was then too late in the season for anything to be done in the matter that year; but in the winter of 1929 a club known as "The Tunart Clydesdale Horse-breeders' Club," was formed with a list of 25 members. The object of the club was to purchase a well-bred Clydesdale stallion to be mated with selected mares in the district. The progeny of such mating, it was hoped, eventually would improve the type and conformation of horses in the district, would replace losses, and would stimulate interest in the Clydesdale breed.

Immediately after the formation of the club, the Clydesdale stallion, Captain Douglas (ten years), by Douglas Chief from Dimora Lass, was purchased from Mr. C. S. Rodda, of "Fairview Stud," Warracknabeal, who was keenly interested in the object of the club, and showed such interest in a practical way by agreeing to accept long terms, interest free, for the purchase price.

The subscription for permanent membership of the club was fixed at £3, and the list is now full with a membership of 40. Only mares approved by the committee are served, the service fee for members being £2, and for non-members (if there are vacancies), £4. These charges may be varied slightly according to the number of mares served each year.

Captain Douglas.

In the first year (1929) a very severe drought was experienced in the district, and only about 25 mares were served by the stallion. Many of the mares were in poor condition, but, in spite of this, fifteen foals were dropped. These are now yearlings, and during a recent visit to Tunart some of them were inspected. Those seen were of good type, and should grow into splendid workers. In the following season some 62 approved mares were served, and of these, only four were the property of non-members. It is estimated that over 50 are definitely in foal, so that after this year's drop, the club may be said to be well on the way to achieving its objective.

Since the formation of the club, both members and non-members have evinced a keener

interest in the breeding operations, and there has grown up a spirit of friendly rivalry which must lead to a definite improvement both in breeding and horse management. As proof of the existence of this spirit the club at the end of last July arranged a most successful horse show and gymkhana which was held on the Tunart Sports Ground. This was said to be the most successful function ever held in the district, and attracted settlers from distances of 20 miles. The programme included classes for dry mares, brood mares, pair of workers, best yearling colt or filly by Captain Douglas, and a long list of ring events. The prize in the mare classes and for the dam of the winning yearling was most appropriate, being a free service from the club's stallion.

During the current year the club also arranged a stock betterment competition for prizes donated by the Royal Agricultural Society of Victoria. Entries for this numbered sixteen, eight being in the group restricted to members of the club and eight in the open group. This competition was judged in August, and created considerable interest in the district. It undoubtedly will result in improving the condition for stock in the settlement, and I have no doubt that, if similar competitions are held in the future, the entries will be more numerous.

The members of the Tunart Club are to be congratulated on what they have already achieved under such adverse conditions, and their example of "helping themselves" might well be followed by farmers in other parts of the State. The formation of such clubs must lead eventually to an improvement in the type and conformation of our draught stock and also in the conditions under which they are kept.

The committee of the club are by no means satisfied yet; their ambition is to increase their membership, and obtain another stallion, for which there is room in the district. They are endeavouring also to interest their members in the breeding of pedigree cattle and pigs, of which at the present time there are few in the district. It is the intention of the club, as funds become available, to endeavour to purchase suitable sires for use on the same line as the club stallion; and I have no doubt that many stud-breeders will interest themselves in this matter, and will give practical assistance to a movement which must ultimately prove of benefit to the live stock industry as a whole. Already one large White York breeder has donated a boar to the club.

Much of the success of the club undoubtedly is due to the energetic honorary secretary, Mr. W. J. Ellison, of Meringur, who would be pleased to supply information on all details in connexion with the formation and running of this club.

Better Farming Train

Tour of Irrigation Districts

WHEN the Better Farming Train leaves Melbourne on 19th October for a tour of the northern irrigation districts, it will carry a comprehensive live stock exhibit, comprising cattle, sheep, pigs, and poultry. Many of these will be of outstanding quality, as arrangements have been made for several prize winners at the recent Royal Show to be carried on the train.

Particular attention will be given to the establishment and management of pastures in regard to which considerable knowledge has been gained by the Department in recent years. Experiments in relation to the composition and manuring of pastures and their maintenance at the maximum productive value are being conducted at several centres, and the results of this work will be demonstrated by actual sods cut from the plots and exhibited on the train.

The amended itinerary of the tour is as follows:—

Tuesday, 20th October.—Dingee.
Wednesday, 21st October.—Terang.
Thursday, 22nd October.—Murrabit.
Friday, 23rd October.—Swan Hill.
Saturday, 24th October.—Pyramid
Monday, 26th October.—Rochester.
Tuesday, 27th October.—Gunbower.
Wednesday, 28th October.—Cohuna.
Thursday, 29th October.—Lockington.

Bots in Horses

W. D. Shew, B.V.Sc., Veterinary Officer.

THE Bot Fly, or Horse Bee as it is often called, is known to cause considerable loss to horse-owners in most parts of the world. In North America, Great Britain, Europe, and Asia, as well as in Australia, serious efforts are being made to control the ravages of this pest.

Bots may cause injury, which in some cases results in the death of the horse, in one of the following ways:—(1) by the fly itself during the process of egg-laying annoying the horse whilst at pasture or at work; (2) in the larval stage by the withdrawal of nutriment both from the stomach and its contents; (3) by the actual obstruction of the passage of food from the stomach to the intestines, especially when the larvae are collected in numbers about the pylorus, or the exit door to the stomach; (4) by injury and irritation to the mucous membrane lining the stomach, due to the penetration of the hooklets by which the larvae are attached; (5) by irritation, injury, and possible penetration of the intestines, rectum and anus, in the passage of the larvae from the horse.

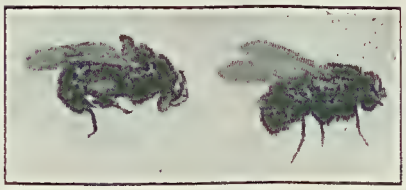
If the stomach or intestinal walls are penetrated by the bots peritonitis is often set up, and this generally causes the death of the horse.

It should be remembered, however, that it is really comparatively seldom that bots actually cause the death of horses. Because a post-mortem indicates that bots are present, they must not necessarily be blamed for the animal's death, unless there is evidence of perforation of the stomach or intestinal wall with peritonitis, or unless they have caused a definite stoppage of the bowel.

Varieties of Bot Fly.

There are three distinct species of horse bot recognized in Australia:—(1) The Common Bot or *Gastrophilus Intestinalis;* (2) the Throat Bot or *Gastrophilus Nasalis;* (3) the Red-tailed Bot (Nose Fly) or *Gastrophilus Haemorrhoidalis.*

1. The Common Bot (*G. Intestinalis*) is the most numerous and is also the largest of the three. The adult is about ½ to ¾ in. in length, has transparent wings with dark spots. The body is yellowish-brown and has dark bands of black spots. The number of eggs laid by the fly varies from 300 to 500. She may lay them anywhere about the horse's body, but generally she hovers round the forelegs, and then, making a sudden dart, deposits one or more eggs about the front legs, usually inside the knees. She repeats this process until all her eggs are safely cemented to hairs on the afflicted horse. The eggs of this species are pale yellow, and are cemented by their lower third to the horse's hairs.



The Horse Botfly. Female left ; Male, right.

They do not hatch out until they have been detached by the horse's licking or biting, and the larvae are taken into the stomach where they usually attach themselves to the white lining of the left sac or round about the duodenal orifice, or opening into the duodenum or small intestines. The exact nature of the food taken by the young bots in the stomach is not quite clear, but they live to a certain extent at the expense of the host. As the colour of many larvae, especially young ones, is reddish, they probably consume an amount of blood.

The larvae of the common bot and the throat bot exist in the stomach of the horse for many months—probably nine or ten—when they are expelled with the faeces. The larvae of the red-tailed bot re-attaches itself in the rectum and usually makes its own exit from the anus, and is not passed with the faeces.

On reaching the ground the bots burrow into loose earth, and in three or four days pupate. The pupal stage will vary according to moisture and temperature, but usually lasts from

three to five weeks, after which the fly emerges. The lives of these flies are very short, probably from a few days up to three weeks—the average is about ten days. The fly does not take food, and the female concentrates on the laying of its eggs. Fertilization of the female probably takes place in the air during flight.

2. The Throat Bot (*G. Nasalis*). This is a smaller fly; it has clear transparent wings, and causes much more annoyance to the horse than does the common bot. It flies rapidly, poises in mid-air, and then dives down to lay its eggs under the throat and about the chin. Each egg is pale yellow, and is cemented to a hair along more than two-thirds of its length, whilst its free end diverges only slightly from the hair to which the egg is cemented.

How the eggs of this species of bot reach the stomach is not known. They hatch out without friction or moisture and probably they drop into the food or water, and so are swallowed and eventually attach themselves to the stomach wall or the duodenal wall (the first portion of the small intestine). Whereas the common bots mostly attach themselves to the covering of the left sac of the stomach (the white wall), the throat bot, if attached in the stomach, will be found at the pyloric or exit end of the stomach. It will also be noticed that the throat bot when fully grown in the stomach is paler in colour than the common bot.

3. The Red-tailed Bot (*Nose Fly—G. Haemorrhoidalis*). This is the smallest of the three species and is much darker in colour being almost black. It has clear transparent wings and a bright orange-red tip to its abdomen. Its eggs are black, and are laid one at a time on the fine hairs round the lips and nostrils. These eggs are laid as close to the edges of the lips as possible, where they can be moistened by saliva. The eggs nearest to the lips hatch out in about five days, are swallowed, and so proceed to the stomach, whilst those even an inch further away may take nearly three weeks to hatch, or may never hatch at all. It is the moisture and friction of the lips that hasten the hatching, and the young maggots may enter the mouth under their own power or may be swallowed in water or food. As mentioned before, there is a strong tendency for the bots of this species to let go their hold in the stomach or small intestine, pass back with the faeces and re-attach themselves in the rectum inside the anus. They remain here for a few days, accustoming themselves to the air. Then they drop off, and pass through the anus of their own volition, and are not passed with the faeces as is the case with the two first-mentioned species.

Treatment.

One is often asked what is the best form of repellent to use to keep bot flies away from horses. No repellent has yet been found to be really successful, but various mixtures are used, e.g., creosote and lard, pine tar and lard, kerosene, lysol, or a 2 per cent. solution of creosote; these mixtures may be smeared over the hairs under the throat, neck, and on the legs, &c.

Protective devices such as fly-nets and cloths soaked in kerosene under the throat are certainly useful, but where horses are at pasture, sheds, or big trees providing heavy shade, are probably of most value, as the bot fly does not enter heavy shade.

The best means of eradication of the larvae is to dose the affected horse. Treatment is as follows:—

Fast the horse for twelve hours, then ball him with a capsule containing carbon disulphide. The dose of this is 6 drams for a horse of about 1,000 pounds. This dosing may be varied by giving two doses of 4 drams each at two-hourly intervals or three doses of 3 drams each with one hour between doses. The single dose is probably best. No food or water should be given for at least four hours after treatment, and on no account should the dose be followed by a purgative; oil is especially dangerous.

It is *inadvisable* to give a purgative before dosing, and great care must be taken in balling the horse, as should the capsule break in his mouth and the drug get into the lungs, he may die. Young and small animals should receive proportionately small doses. Old and debilitated horses should be looked upon as risky cases for treatment.

Bot larvae may be passed for two or three weeks after treatment, and individual horses have been known to pass over 500 larvae, whilst in post-mortems in extreme cases over 1,000 larvae have been recorded as being present in the abdominal contents.

Codling Moth Control

Competitive Spraying Tests

A. A. Hammond, Senior Supervisor, Horticultural Division.

THE spraying tests commenced in the 1929-30 season at the request of the Metropolitan Fruit Growers' Association were continued during the 1930-31 season in the same blocks as in 1929-30, Messrs. T. H. Petty and W. A. Thiele again making their orchards available for the purpose. Five leading suppliers of spraying materials took part in the tests at Mr. Thiele's orchard, and the same firms, with the exception of Lawford and Company, took part in the tests at Mr. Petty's orchard at Templestowe.

It was found that some of the Jonathan apples sprayed in previous tests developed spot blemish when in cold storage, and the Keiffer pears, it was stated, yellowed prematurely, which gave them the appearance of being ripe, and consequently detracted from their value. Such injurious effects on the fruit were thought to be due to the use of too large a dosage of oil in the arsenate-oil combination.

It was decided, in the recent tests, to reduce the oil dosage and eliminate it altogether in some of the tests in the last spraying.

In view of the doubt as to the relative efficiency of the oil-arsenate combination and arsenate only, and also as to the effect of these sprays on the keeping quality of the fruit, it was suggested to two of the firms, viz., Lawford and Company, and Jaques Pty. Ltd., that arsenate only be applied on the plots allotted to them in Mr. Thiele's pear block. Arsenate only was to be used by Jaques Pty. Ltd., on its Jonathan plot at Mr. Petty's orchard. The suggestion was agreed to.

In the pear block, plots A, C, and D were treated with the arsenate-oil combination; plots B and C with arsenate only. There were approximately twelve trees in each plot.

Plots F1, F2, and F3 were treated with the arsenate-oil combination. Each of the three brands of oil used in plots A, C, and D was combined with Elephant brand arsenate of lead paste. Spreaders were used in all the spraying mixtures, except in the calyx application.

The conditions to be observed by those taking part in the tests were the same as in the previous tests.

A power pump supplied by the orchardists concerned was used, the pressure ranging from 270 to 320 lb. to the square inch. In plots F1, F2, and F3, in each of which there were only two trees, the spray was applied with a small hand pump.

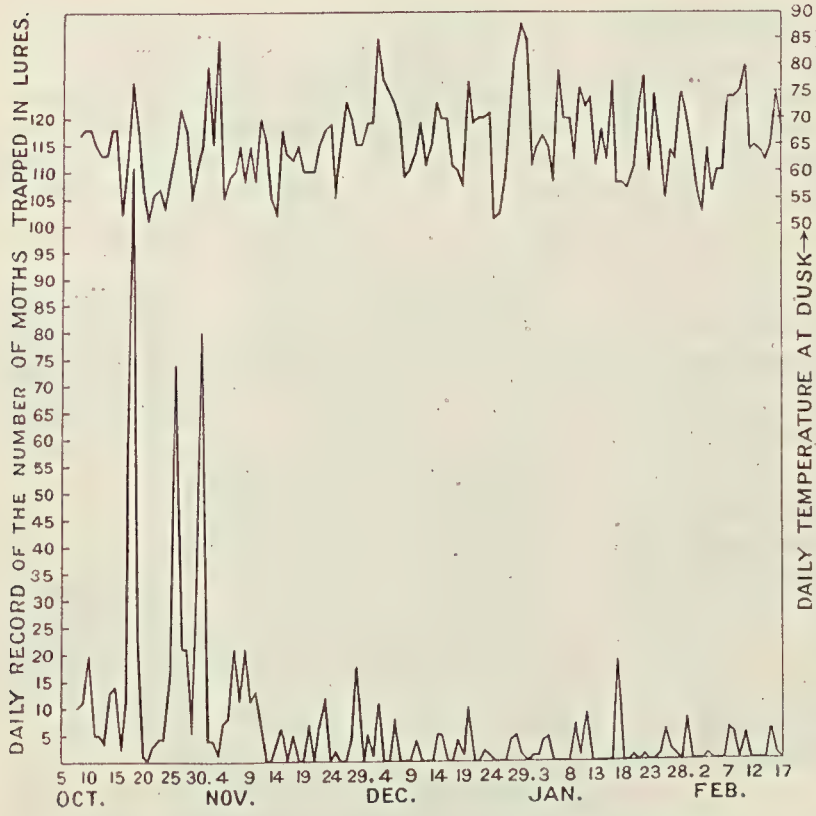
The date of application and materials used in the various tests are set out in tables. The cost of materials and application also are given.

Lures.

Lures for the purpose of trapping moths were used as in the previous test. The lure mixture was made by adding one part of molasses to sixteen parts of water. Earthenware fern-pots holding one-half gallon of liquid filled to within 2 inches of the top were hung high in one tree on each plot.

A daily record of the moths trapped and the temperature at dusk was recorded by Mr. W. A. Thiele from 8th October till 17th February inclusive. After this date it was found impracticable, owing to pressure of work, to record the number of moths trapped daily. However, it may be said that comparatively few were trapped after the dates recorded. The accompanying graph shows the daily trappings and temperatures.

Specimens of moths were submitted to the biologist, who determined that 60 per cent. were females. The fact that 850 were trapped in six lures during the period mentioned shows


DAILY RECORD OF THE NUMBER OF MOTHS TRAPPED IN LURES.
DAILY TEMPERATURE AT DUSK→
5 10 15 20 25 30. 4 9 14 19 24 29. 4 9 14 19 24 29. 3 8 13 18 23 28. 2 7 12 17
OCT. NOV. DEC. JAN. FEB.

Graph showing daily trappings of moths and temperatures.

clearly that lures are an important supplementary control measure, as the females captured would be capable of depositing over 50,000 eggs. It is worthy of note that, as in the previous tests, the lures did not attract the moth so much when the fruit was maturing as early in the season, and probably for the reason given in my report on last season's test. (See this *Journal* for July, 1930.)

The experiment in plots F1, F2, F3 was designed to test, if possible, the relative values of the white oils used in the test plots, different brands of oil being used with the same brand of arsenate and casein spreader.

The times of applying the spray were varied also. Table I. shows that the trees in these plots were not sprayed between 18th December and 4th February, as during this period there was little evidence of moth activity.

Spray Blemish.

For the purpose of determining the effect on the fruit of the spraying mixtures used, a bushel of fruit was taken from each of the test plots and kept in cool storage.

The Jonathan apples were harvested on 25th February, and taken on the same day to the Government Cool Stores, Victoria Dock, and placed in cool storage. The Keiffer pears were harvested on 1st April, and stored in the Doncaster Cool Stores till 9th April, when they were taken to the Government Stores at Victoria Dock. The whole of the fruit was removed from the Cool Stores on 15th June, and kept at the Horticultural Offices till 7th July.

As regards blemish, there was no appreciable difference between the appearance of the fruit from any of the plots. The apples sprayed with the arsenate oil combination did not show any blemish as a result of the spray, nor did the pears have the appearance of maturity, and "yellow" prematurely, as it was alleged they did when sprayed with the oil arsenate combination in the previous tests. Thus, it would appear that with the reduced dosage of oil used there is no danger of blemishing apples, nor of giving pears the appearance of being ripe.

Tables I. and II. show the dates of application and the materials used in the different plots, and also the percentage of infection. As in the previous tests infested fruit was classified as "grubs" or "stings," the latter term applying when the caterpillar had been destroyed just after penetrating the skin.

Although the oil-arsenate combination was more costly, the increased cost was more than counterbalanced by the more efficient control obtained, and it should be remembered also that the effect of such control is cumulative.

Spray Damage.

As pointed out previously, no appreciable damage was done to the fruit in any of the test plots that could be attributed to the

materials used in the spraying mixtures, but the foliage of Jonathan trees in two of the test plots in Mr. Petty's orchard was affected; this, however, was probably due to the use of contaminated water. On 16th December, whilst spraying operations were being carried out, the upper portion of a large galvanized iron tank, from which water was drawn, collapsed, and rust and other accretions were precipitated into the remaining water. It was found several days later that the foliage of the trees in plot C was badly burnt. The foliage of the trees in plot A, with the exception of that of six trees, was also damaged. Water from the tank mentioned was used on both plots, except that a casein spreader was added to the mixture used on the uninjured trees in plot A.

This shows the importance of clean water for spraying purposes, particularly when combined sprays are used and the margin of safety is small. It also proves the value of casein in preventing or retarding chemical reaction.

It should be mentioned that when the burning of the leaves was noticed, the tank from which the water was drawn was dry, otherwise a sample of the water would have been submitted for analysis.

Appearance of Fruit.

There was no important difference observable in pears from the trees sprayed with the different preparations. But apples from the trees sprayed with the oil-arsenate casein-combination, and from those sprayed with the arsenate-casein spray were brighter and more uniformly coloured. Both the vegetable spreader contained in arsinette and the gelatine liquid spreader caused a blotch spray, which not only rendered the fruit unsightly, but gave it the appearance of containing much more residual arsenic than it actually did. The apples treated with the oil-arsenic combination had the better appearance when held after cool storage, and their keeping qualities appeared to be improved.

The experiment was not on a sufficiently large scale to enable a definite conclusion to be arrived at, but the indications are that a reduced dosage of oil, say ½ gallon to 80 in the later sprayings, would have the effect of improving the keeping quality of some varieties of apples.

Twenty-five fruits were taken from each plot and submitted to the Agricultural Research Chemist for analysis. The result of the analysis shows that in some instances the fruit contained considerably more than the permissible amount of residual arsenic, the statutory limit of which is .01 grains per lb. of fruit. This applies particularly to the plots where a rather heavy dosage of oil was used throughout the season.

The last spraying of the apple trees was given only twelve days before harvesting, consequently there was much more spray residue than there would have been had the fruit remained on the trees the usual time after spraying. The pears, also, were harvested much earlier than usual, there being only 21 days between the last spraying and harvesting.

In the previous season the apples and pears were harvested approximately a month later. Table II. shows the number of applications of the different materials used, the cost of the different programmes, the percentage of clean fruit obtained, and the amount of residual arsenic on the fruit when harvested. To arrive at the cost of the different spraying programmes, it was assumed that an equal quantity of the spraying mixtures was used. The cost of labour and plant to apply 80 gallons of spray is estimated to be 6s.

It will be seen by referring to Table III. that the infection in plot F3A was over 6 per cent. more than in plot F3. The treatment of these plots was exactly the same except that the calyx spray was omitted in the former plot.

This shows the importance of the calyx spray, at least when the moth is active early in the season, as was the case in the season just past.

The amount saved by omitting this spray would be, approximately, 9s. 4d., including cost of application, and assuming that 40 trees carrying 150 bushels could be sprayed, the loss would be, say, 9 bushels, which at 4s. a bushel would amount to £1 16s.

To make the information from the experiment as accurate as possible, all windfalls were checked several times during the season, and all infected fruit on the trees were counted. The District Supervisor, Mr. F. J. Greatorex, and Mr. A. Jones, Orchard Supervisor, assisted in this work, and Mr. Greatorex also assisted in the supervision of the spraying of test plots.

Table I.—Codling Moth Control.

Spraying tests at Mr. W. A. Thiele's orchard, Doncaster.

Each plot consisted of twelve Keiffer's hybrid Pears.

Plot A—Shell Co.

Date of Spraying.	Materials Used.	Water. Gallons.
2nd October, 1930 21st October, 1930	3 lb. Berger's arsenate of lead powder	100
20th November, 1930	2 lb. Berger's arsenate of lead powder, ¾ gall. Shell white spray	80
16th December, 1930 14th January, 1931 12th February, 1931	2 lb. Berger's arsenate of lead powder, ¾ gall. Shell white spray, ½ lb. Neptune Spreader	80
12th March, 1931	2 lb. Berger's arsenate of lead powder, ¼ gall. Shell white spray, ½ lb. Neptune Spreader	80

Infection.—Grubs, 2·09 ; stings, ·49 ; total infection, 2·58. Uninfected, 97·42.

Plot B—Lawford and Co.

2nd October, 1930	2½ lb. Electro arsenate powder, ¾ lb. Fluxit Spreader	80
21st October, 1930 19th November, 1930 16th December, 1930 14th January, 1931 12th February, 1931	2½ lb. Electro arsenate powder, 4/5 lb. Fluxit Spreader	80
12th March, 1931	1¾ lb. Electro arsenate powder, ½ lb. Fluxit Spreader	80

Infection.—Grubs, 5·22 ; stings, 1·59 ; total infection, 6·81. Uninfected, 93·19.

Plot C—Cooper and Nephew.

2nd October, 1930	3 lb. Arsinette powder	100
21st October, 1930 19th November, 1930 16th December, 1930 14th January, 1931 12th February, 1931 12th March, 1931	3 lb. Arsinette powder, 1 gall. Alboleum (white oil)	100

Infection.—Grubs, 2·07 ; stings, ·91 ; total infection, 2·98. Uninfected, 97·02.

Plot D—Pannifex and Co.

2nd October, 1930	3 lb. Ortho arsenate powder, ⅓ pint Delmonte Spreader	100
21st October, 1930	3 lb. Ortho arsenate powder, ⅓ pint Delmonte Spreader, 1 lb. limal	100
19th November, 1930 16th December, 1930	2½ lb. Ortho arsenate powder, ¾ gall. Orthol K (white oil)	100
14th January, 1931 12th February, 1931	2½ lb. Ortho arsenate powder, ¾ gall. Orthol K (white oil), ⅓ pint Delmonte Spreader, 1 lb. limal	100
12th March, 1931	3 lb. Ortho arsenate powder, 1 lb. Kayso Spreader	100

Infection.—Grubs, 2·29 ; stings, ·81 ; total infection, 3·10. Uninfected, 96·90.

Plot E—Jaques Pty. Ltd.

2nd October, 1930 21st October, 1930	5 lb. Elephant Brand arsenate of lead paste	80
19th November, 1930	5 lb. Elephant Brand arsenate of lead paste, ½ lb. Elephant Brand Spreader	80
16th December, 1930	5 lb. Elephant Brand arsenate of lead paste, 10 oz. Elephant Brand Spreader	80
14th January, 1931	5 lb. Elephant Brand arsenate of lead paste, ¾ lb. Elephant Brand Spreader	80
12th February, 1931 12th March, 1931	5 lb. Elephant Brand arsenate of lead paste, ½ lb. Elephant Brand Spreader	80

Infection.—Grubs, 6·79 ; stings, 1·16 ; total infection, 7·95. Uninfected, 92·05.

Table I.—*continued.*

Spraying tests at Mr. W. A. Thiele's orchard—*continued.*

PLOT F1—DEPARTMENTAL TEST (two Keiffer's hybrid pears in each plot).

Date of Spraying.	Materials Used.	Water. Gallons.
2nd October, 1930 21st October, 1930	5 lb. Elephant Brand arsenate paste	80
19th November, 1930	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80
18th December, 1930	5 lb. Elephant Brand arsenate paste, ¾ gall. Shell white spray, ½ lb. Elephant Brand Spreader	80
4th February, 1931	5 lb. Elephant Brand arsenate paste, ½ gall. Shell white spray, ½ lb. Elephant Brand Spreader	80
5th March, 1931	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80

Infection.—Grubs, 1·14 ; stings, ·12 ; total infection, 1·26. Uninfected, 98·74.

PLOT F2—DEPARTMENTAL TEST (two trees).

2nd October, 1930 21st October, 1930	5 lb. Elephant Brand arsenate paste	80
19th November, 1930	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80
18th December, 1930	5 lb. Elephant Brand arsenate paste, ¾ gall. Alboleum, ½ lb. Elephant Brand Spreader	80
4th February, 1931	5 lb. Elephant Brand arsenate paste, ½ gall. Alboleum, ½ lb. Elephant Brand Spreader	80
5th March, 1931	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80

Infection.—Grubs, 4·15 ; stings, ·62 ; total infection, 4·77. Uninfected, 95·23.

PLOT F3—DEPARTMENTAL TEST (one tree).

2nd October, 1930 21st October, 1930	5 lb. Elephant Brand arsenate paste	80
19th October, 1930	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80
18th December, 1930	5 lb. Elephant Brand arsenate paste, ¾ gall. Orthol K, ½ lb. Elephant Brand Spreader	80
4th February, 1931	5 lb. Elephant Brand arsenate paste, ½ gall. Orthol K, ½ lb. Elephant Brand Spreader	80
5th March, 1931	5 lb. Elephant Brand arsenate paste, ½ lb. Elephant Brand Spreader	80

Infection.—Grubs, 4·27 ; stings, 1·03 ; total infection, 5.30. Uninfected, 94·70.

NOTE.—In this plot, owing to the proximity of a badly infested check-tree, the percentage of infection was doubtless higher than would otherwise have been the case.

PLOT F3A—(one tree).

This plot received similar treatment to F3, except that the calyx spray of 2nd October was omitted.

Infection.—Grubs, 9·87 ; stings, 1·54 ; total infection, 11·41. Uninfected, 88·59.

Table II.—Codling Moth Control.

Spraying tests at Mr. H. Petty's Orchard, Templestowe.
Each plot consisted of eighteen Jonathan Apple Trees.

PLOT A—PANNIFEX AND CO.

Date of Spraying.	Materials Used.	Water. Gallons.
21st October, 1930	3 lb. Ortho arsenate powder, ⅓ pint Delmonte Spreader, 1 lb. limal	100
19th November, 1930 16th December, 1930	2½ lb. Ortho arsenate powder, ¾ gall. Orthol K (white oil)	100
15th January, 1931	2½ lb. Ortho arsenate powder, ¾ gall. Orthol K (white oil), ⅓ pint Delmonte Liquid Spreader, 1 lb. limal	100
12th February, 1931	2½ lb. Ortho arsenate powder, ¾ gall. Orthol K (white oil), ⅓ pint Delmonte Spreader, 1 lb. limal	100

Infection.—Grubs, 1·38 ; stings, 1·20 ; total infection, 2·58. Uninfected, 97·42.

Table II.—*continued.*

PLOT B—JAQUES PTY. LTD.

Date of Spraying.	Materials Used.	Water. Gallons.
21st October, 1930	5 lb. Elephant Brand arsenate of lead paste	80
19th November, 1930 16th December, 1930	5 lb. Elephant Brand arsenate of lead paste, ½ lb. Casein Spreader	80
14th January, 1931	5 lb. Elephant Brand arsenate of lead paste, ¾ lb. Casein Spreader	80
13th February, 1931	5 lb. Elephant Brand arsenate of lead paste, ½ lb. Casein Spreader	80

Infection.—Grubs, 2·43 ; stings, 1·64 ; total infection, 4·07. Uninfected, 95·93.

PLOT C—COOPER AND NEPHEWS.

21st October, 1930	3 lb. arsenate powder	100
19th November, 1930 16th December, 1930 15th January, 1931 13th February, 1931	3 lb. arsenate powder, 1 gall. Alboleum (white oil)	100

Infection.—Grubs, 1·31 ; stings, 1·10 ; total infection, 2·41. Uninfected, 97·59.

PLOT D—SHELL CO.

21st October, 1930 19th November, 1930	3 lb. Berger's arsenate of lead powder	100
16th December, 1930 15th January, 1931	3 lb. Berger's arsenate of lead powder, ¾ gall. Shell white spray, ½ lb. Berger's Casein Spreader	80
13th February, 1931	3 lb. Berger's arsenate powder, 5 pints Shell white spray, ½ lb. Berger's Casein Spreader	80

Infection.—Grubs, 1·91 ; stings, 1·30 ; total infection, 3·21. Uninfected, 96·79.

Table III. shows the cost of the different spraying programmes, including the cost of application, the number of applications, the percentage of uninfected fruit, and the amount of residual arsenic in grains per lb. of fruit in Mr. Thiele's Pear Block and Mr. Petty's Apple Block.

Table III.

Name of Firm and Plot.	Spray Used.	Number of Applications.	Cost of Programme.	Percentage of Clean Fruit.	Spray Residue.
	Pear Block.				
			£ s. d.		
Plot A— Shell Oil Coy.	(*a*) Berger's Arsenate + Shell Oil (*b*) Berger's Arsenate	5 2	4 8 3	97.42	.091
Plot B— Lawford and Co.	Electro Arsenate	7	3 12 4	93.19	.029
Plot C— Cooper and Nephew	(*a*) Arsinette + Alboleum (*b*) Arsinette	6 1	4 19 2	97.02	.157
Plot D— Pannifex and Co.	(*a*) Ortho Arsenate + Orthol K (*b*) Ortho Arsenate	3 4	3 19 11	96.90	.054
Plot E— Jaques Pty. Ltd.	Elephant Brand Arsenate	7	3 7 1	92.05	.042
Plot F1— Departmental Test	E.B. Arsenate + Shell Oil Elephant Brand Arsenate	2 4	3 5 6	98.74	.065

Table III.—*continued.*

Name of Firm and Plot.	Spray Used.	Number of Applications.	Cost of Programme.	Percentage of Clean Fruit.	Spray Residue.
			£ s. d.		
	Pear Block—continued.				
Plot F2— Departmental Test ..	E.B. Arsenate + Alboleum	2	3 5 6	95.23	..
	Elephant Brand Arsenate	4			
Plot F3— Departmental Test ..	E.B. Arsenate + Orthol K	2	3 5 0	94.70	..
	Elephant Brand Arsenate	4			
Plot F3A— Departmental Test ..	E.B. Arsenate + Orthol K	2	2 15 8	88.59	..
	Elephant Brand Arsenate	3			
	Apple Block.				
Plot A— Pannifex and Co. ..	Ortho Arsenate + Orthol K	4	3 8 7	97.42	.027
	Ortho Arsenate	1			
Plot B— Jaques Pty. Ltd. ..	Elephant Brand Arsenate	5	2 8 4	95.93	.051
Plot C— Cooper and Nephew	Arsinette + Alboleum	4	3 19 6	97.59	.057
	Arsinette	1			
Plot D— Shell Oil Co. ..	Berger's Arsenate + Shell Oil ..	3	3 7 4	96.79	.045
	Berger's Arsenate	2			

Reports by Agricultural Research Chemist on Samples of Spray Spreaders, and White Oil.

(1).—SPRAY SPREADERS.

SAMPLES.

1. Elephant Brand Spray Spreader.
2. Delmonte Liquid Spray Spreader.
3. Fluxit Spray Spreader.
4. Neptune Spray Spreader.

RESULTS OF ANALYSIS.

No. 1.—This sample was found to contain—

Moisture	10.6 per cent.
Ash	23.3 „
Casein	52.9 „
Slaked lime ..	7.8 „

It is essentially a mixture containing approximately 53 per cent. casein and 8 per cent. slaked lime with 11 per cent. moisture, the remainder being an alkaline substance, probably carbonate of soda.

No. 2.—This sample was found to be essentially a liquid glue containing 70 per cent. moisture.

No. 3.—This is an ordinary lime-casein spreader containing approximately—

Moisture	3.3 per cent.
Casein	15.3 „

Lime—remainder, mainly as slaked lime.

No. 4.—This also is a lime-casein mixture—

Moisture	3.8 per cent.
Casein	32.0 „

Lime—remainder, mainly as slaked lime.

(2).—WHITE OIL.

SAMPLE.

Shell white oil as used in Doncaster and Templestowe tests.

RESULTS OF ANALYSIS.

Moisture	8.5 per cent.
White oil	88.0 „
Alkalinity (as caustic soda)	0.3 „

Burnley Egg-Laying Competition

Winter Test Results

By W. C. Rugg, Chief Poultry Expert.

THE winter test conducted in connexion with the Burnley Egg-Laying Competition commenced on 1st April and concluded on 31st July—a period of 122 days. Although the weather conditions during that period were very severe, some splendid scores were made by both fowls and ducks.

The best score in the light breed section for teams of six birds was put up by a team of White Leghorns, owned by Miss L. M. Roberts, of Pascoe Vale. This team laid 483 first-grade eggs. In the single test section a White Leghorn owned by Mr. J. L. Edgcumbe, Diamond Creek, laid 115 first-grade eggs in the 122 days.

In the section for heavy breeds a team of six Australorps, owned by Mr. C. E. Graham, Portarlington, laid 543 first-grade eggs. One of this team won the certificate for highest individual score with 104 first-grade eggs.

The winning team in the section for ducks was one of six Khaki Campbells, owned by Broadleigh Egg Farm, Spring Vale. This team laid 634 eggs, all of which were first grade. Best score of the single-tested ducks was that of a Khaki Campbell, owned by Mr. N. W. Kerr Clark, of Mornington, which laid 121 first-grade eggs—one short of the possible.

The prize winners are as follow:—

HENS.

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Section A.—Teams of Six Birds, Trap Nested.—Light Breeds.			
1st Prize.—Champion Certificate.			
Miss L. M. Roberts, Pascoe Vale .. (White Leghorns)	488	5	483
2nd Prize.—Government Certificate.			
J. L. Edgcumbe, Plenty .. (White Leghorns)	420	6	414

Hens—*continued.*

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Individual Birds.—Light Breeds.			
1st Prize.—Champion Certificate.			
A. G. Fraser, Horsham .. .. (White Leghorn)	99	..	99
2nd Prize.—Government Certificate.			
J. L. Edgcumbe, Plenty .. (White Leghorn)	98	4	94
Teams of Six Birds, Trap Nested.—Heavy Breeds.			
1st Prize.—Champion Certificate.			
C. E. Graham, Portarlington .. (Australorps)	563	20	543
2nd Prize.—Government Certificate.			
H. J. Hulme, Milawa .. .. (Australorps)	526	5	521
Individual Birds.—Heavy Breeds.			
1st Prize.—Champion Certificate.			
C. E. Graham, Portarlington .. (Australorp)	104	..	104
2nd Prize.—Government Certificate.			
H. J. Hulme, Milawa .. .. (Australorp)	104	2	102
Section B.—Individual Birds, Single Test.—Light Breeds.			
1st Prize.—Champion Certificate.			
J. L. Edgcumbe, Plenty .. (White Leghorn)	115	..	115
2nd Prize.—Government Certificate.			
T. L. Easthaugh, Highett .. (White Leghorn)	107	..	107
Heavy Breeds.			
1st Prize.—Champion Certificate.			
Mrs. Kerry, Hampton .. .. (Australorp)	103	..	103
2nd Prize.—Government Certificate.			
H S. Andersen, Caulfield .. (Australorp)	102	..	102

(Continued on page 515.)

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

THE time has arrived for the planting out of bedding plants and annual flowering plants to provide a summer and autumn display. Foliage and colour scheme plants include Pyrethrum (golden foliage), Bedding Begonia (pink flowers, dark foliage), Iresène (red leaves), Lobelia (blue flowers), Bonfire Salvia (scarlet flowers), Dwarf French Marigold (yellow and brown flowers), and Alternanthera (red and yellow leaves). Very beautiful and ornamental beds and borders may be made by planting alternate rows or blocks of these plants, placing them so that the colours harmonize.

Regularity of growth is an important factor in the neat and trim appearance of these colour designs in the garden. Some of the plants will always grow ahead of the others and so spoil the evenness of the bed. These should be periodically pinched back so as to bring about a regular growth.

Larger plantings may be made of all summer flowering annuals. The soil should be deeply dug, and a good supply of manure worked into it. Where spreading types of plants are set out, such as Phlox and Asters, or where the plants are tall growing, such as French and African Marigolds, the individual plants should be set out at about a distance of 9 inches, while a distance of 6 inches would be enough for narrower growing plants like Zinnias. Keep all of these plants sprinkled during dry and windy weather.

The Vegetable Garden.

Asparagus beds should be regularly cut over; no long stems must be left to grow. All their stems, not required for cooking, must be cut away. Asparagus and rhubarb beds should be freely watered in the growing season.

Bonfire Salvia.

When thyme, sage, and marjoram are in flower, the plants should be cut down for drying. The herbs should be cool-air dried, and not exposed to the sun during the drying process. When dry, the foliage should be rubbed or sieved from the stems, which are useless. When the leafage is thoroughly dry, it should be stored in air-tight bottles or jars. Mint may be dried in the same way, when there are surplus growths on the plant. During the cutting season, the mint bed should be given a dressing of blood manure, or of liquid stable manure. Excessive cutting, without feeding, soon exhausts the bed.

Tomatoes, melons, marrows, and cucumbers and similar plants should be both well watered and manured. The tops of melons, cucumbers, &c., should be pinched back to encourage lateral growths. Sowings of French beans, both bush and runner, should now be made for the main crop.

In the Orchard.

Apple and pear growers will be having a busy time with the Codling Moth spraying. Arsenate of lead is the long-established spray for this pest, but it has recently been shown by departmental experiments that perfect control cannot be gained by the use of this poison spray alone.

The calyx spray, which is the important one, should be given; it should consist of 5 lb. of lead paste to 80 gallons of water. There should be two calyx sprays, an interval of ten days intervening between them during the flowering or late flowering period. Then, at intervals of approximately one month, there should be three or four sprays of a white oil emulsion of a strength of 1 in 40 gallons of water. By such sprays, excellent results were obtained at the recent Harcourt trials.

Weather conditions should always be taken into consideration when spraying operations are being carried out. Rain or heavy dews always interfere with spray results, and necessitate a re-spraying.

Ensilage Without a Silo

By T. H. Rowe, Dairy Supervisor.

IN the spring, on the farm of Mr. W. T. Jephson, of Stacey's Bridge, near Yarram, a quantity of rye grass and clover is cut for ensilage. Cutting is usually commenced about the end of October, and is carried on into November, when the plants are just coming into flower, and consequently are still fairly green.

The practice is to cut such a quantity on one day as can be conveniently carted on the following day; sometimes, however, the grass cut in the morning is gathered in the afternoon of the same day. It is stacked in an enclosure about 14 feet square, marked by corner posts securely wired together at the top to prevent spreading.

As the stack is being built, it is kept well tramped, and the sides are made a little higher than the middle. At the end of each day, it is weighted with fencing posts, about a ton in all. As the stack grows, this weight will depress it as much as 3 feet during the night. The building of the stack is completed by thoroughly filling in the centre. A layer of earth about 15 inches deep is then placed on top; this layer is kept in position by placing bags containing soil around the edge of the stack.

A stack 14 feet by 14 feet, and 12 feet high, will hold from 25 to 30 tons of ensilage; the necessary grass and clover for this can be obtained from 8 acres on this property.

I have been at Mr. Jephson's farm when a stack has been opened at the end of April. The contents were in splendid order, having matured well, and being quite free from mould. The only waste was on the outside edges.

Here the ensilage had been spoiled by the weather to a depth of 6 or 7 inches.

An analysis by the departmental chemist of a sample of ensilage from Mr. Jephson's farm containing between 60 and 70 per cent. rye grass, and the balance clovers, gave the following result:—

	Per cent.
Moisture	77.12
Ash	2.75
Crude protein	5.55
Albumenoid protein	2.08
Amide protein	3.47
Fat	1.68
Crude fibre	6.36
Nitrogen-free extract	65.54

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Experiments in the Control of Hoary Cress

No. 2.—Pot Experiments

By A. Morgan, B.Agr.Sc., Weeds Research Officer.

The first Article which outlined the field experiments in the control of Hoary Cress appeared in the August issue of this Journal.

IN order further to test out the validity of the tentative conclusions which had been arrived at in regard to the influence of weather conditions and other factors on the efficiency of the arsenic pentoxide spray, it was decided to carry out a series of experiments with *single plants* grown under an environment of soil and moisture as nearly uniform as possible for all the plants in the tests. The establishment of a uniform environment in a number of pots is not, however, a simple matter, and in view of the practical difficulties which will be described a number of compromises necessarily were adopted.

The information desired from pot experiments was, mainly, the total amount of arsenic pentoxide absorbed by a hoary cress plant of known age, the depth to which the absorbed arsenic pentoxide penetrated within the root-system, and the extent to which the total absorption and the depth of penetration were influenced by:—

i. the amount of spray applied;
ii. the weather conditions prior to spraying;
iii. the amount of moisture present in the soil occupied by the root-system, and
iv. mechanical injury to the foliage and stems immediately prior to spraying.

The selection of a suitable type of pot for use in these tests was governed by the considerations of root-room, cost, and ease of removal of the root-systems of the treated plants. Field studies suggested that single-plant experiments with plants whose roots had not penetrated to a depth of about 5 feet were not likely to be of practical value. On the other hand, the divergence of the "lateral" roots from the main root being usually slight under field conditions, pots of large diameter were considered unnecessary for the normal development of "lateral" roots. A deep pot of small diameter was thus indicated.

The third requisite—that of ease of removal of the root-systems of the treated plants—was more difficult to incorporate. Since the determination of the depth of penetration of the spray was an important feature of the test, closed pots were ruled out, and it became necessary to devise a "container," from which the soil column could be removed intact, rather than a pot.

The final choice was a wooden container formed from four rough-dressed hardwood slabs 5 feet x 9 inches x 1 inch, two of which were grooved ½ inch x ½ inch, while two were "rabbitted" ½ inch x ½ inch; the bottom plate consisted of a piece of similar timber 8 inches x 7 inches x 1 inch. The assembly of these is shown in Diagram No. 2.

After tarring the timber, 96 containers were placed in position, in trenches, with their tops level with the ground surface. They were then filled, with periodic ramming, with a mixture of two parts of river sand to one part of surface soil from a field free from hoary cress, the whole of the soil-sand mixture having been thoroughly screened and mixed. In order thoroughly to consolidate the soil columns, the trenches with the filled containers in position were alternately filled with water and pumped out, the containers being refilled with soil after each watering until no further subsidence took place; by this means porous unbroken columns were obtained.

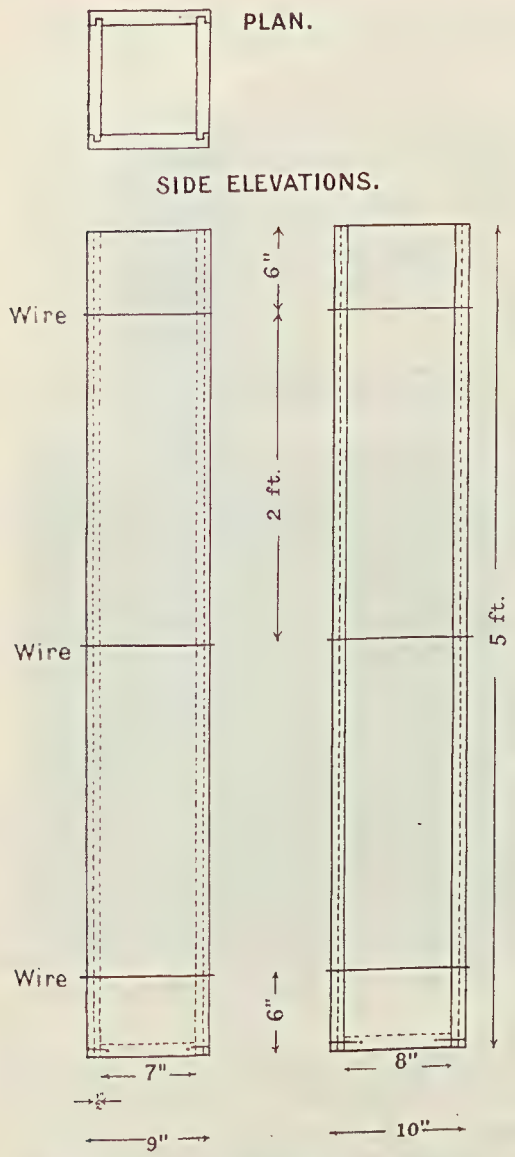


Diagram 2.—Showing dimensions and assembly of containers used in Hoary Cress tests.

After filling the trenches to 18 inches from the surface with water, one seedling plant of hoary cress was transplanted to a central position in each container in August, 1928. At this planting, a surface mulch of coarse bluestone "screenings" was placed on each container, and the water level in the trenches was gradually reduced. During the first season of growth, vigorous root development took place, roots up to 3 ft. 6 in. being observed on some plants examined, but the plants remained without exception in the "rosette" stage. For this reason, no tests were carried out during this season. In the following season the plants flowered, and the sprayings were commenced.

EXPERIMENTAL TECHNIQUE.

The containers were first divided into two groups selected at random in order to test out the influence of soil moisture on spray efficiency. As no facilities were then available for critical work, it was decided to test out only the extremes of soil moisture on this occasion. Forty-eight of the containers were removed from the trenches in July, 1929, and allowed to dry out in a vertical position. As the tests during this season were exploratory, and intended primarily to narrow the field of experimentation during subsequent tests, no provision was made for replication of the various tests carried out on any one day, although it was realized that the experimental errors with single plants would be large. It was hoped, however, that the repetition of the same tests on different days would provide sufficient replications to materially reduce those errors. The allocation of the containers to the various sections of the trial is shown in Diagram No. 3.

For the spraying of the plants a small atomizer was used. It was found that 40 cubic centimeters of fluid were necessary for a good coverage of the leaves and stems of a single plant, so this amount was adopted as a standard in all the sprayings, the variation in the amount of arsenic pentoxide applied per plant being obtained by using strengths of 6 per cent., 3 per cent., 1½ per cent., and 0.6 per cent. respectively. These applications were equivalent, according to the 8 inch x 7 inch cross-section of the container, to field plot sprayings of 2,400, 1,200, 600, and 240 milligrammes per square foot respectively. The whole of this amount was not always retained on the leaves and stems; but this, of course, happens equally often in field sprayings.

In the section devoted to tests of the influence of mechanical injury to the plant immediately before spraying (see Diagram No. 3), on the efficiency of the spraying, half of the plants were stripped of their leaves, the others having their stem epidermis scraped off by means of a sharp knife in addition to defoliation; following these treatments the

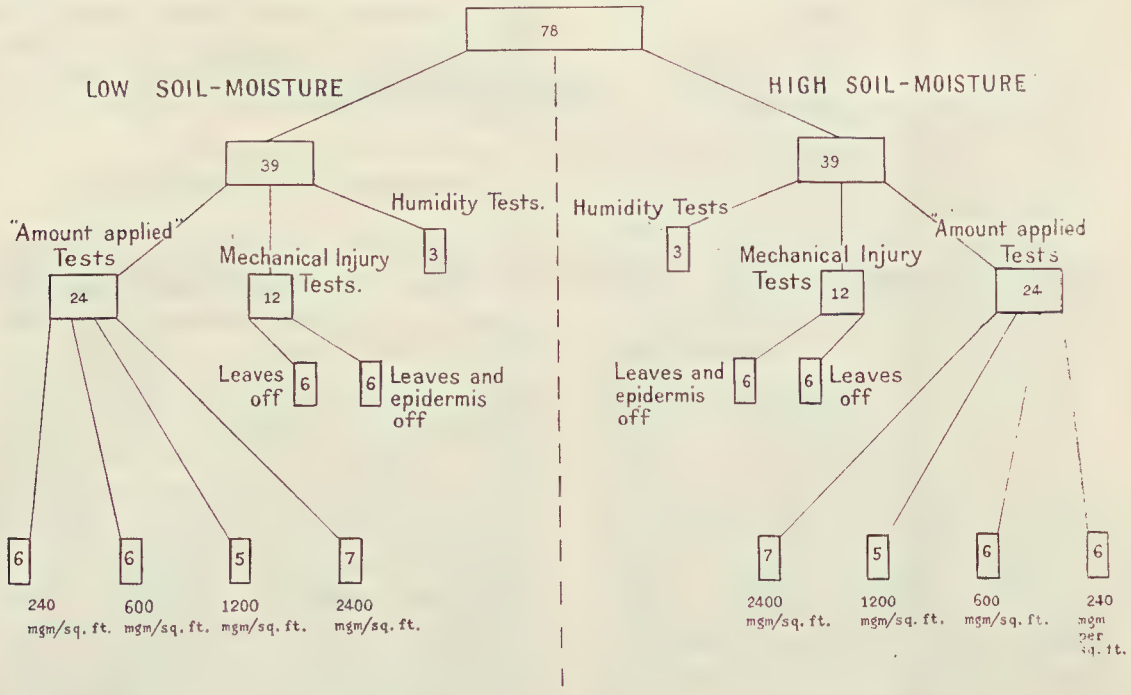


Diagram 3.—Showing the allocation of the plants used in single-plant tests of arsenic pentoxide spray on Hoary Cress.

plants were sprayed with 40 cubic centimeters of a 6 per cent. arsenic pentoxide solution.

In the section marked "Humidity Tests" on Diagram No. 3, an attempt was made to determine the influence of high humidity on the absorption of the spray. As in the case of soil moisture, critical work was not possible, but by not allowing the water transpired by the plant to escape from its immediate vicinity an atmosphere of continuously high humidity was created—small wooden boxes with a top and two sides of glass being placed over the plants. That photosynthesis was able to proceed to some degree was evidenced by the maintenance of apparently healthy conditions of the chlorophyll of the leaves and stems, while the condition of high humidity was shown by the condensation of water on the glass, especially for the first 48 hours. After a week of such conditions, the boxes were removed, and the foliage sprayed with 40 cubic centimeters of 6 per cent. spray solution.

Commencing on 15th October, 1929, a series of twelve plants corresponding to the "Amount applied" and "Mechanical injury" tests under low and high soil-moisture conditions were sprayed at intervals until the drying-out of the soil-columns in the low soil-moisture series of containers became so pronounced as to cause permanent wilting, at which stage the tests were necessarily concluded (7th November, 1929). The removal of the root-systems of the sprayed plants was deferred until 28th January, 1930, in order to obtain data in regard to the rate and percentage of revival of the plants in the various sections of the test. For purposes of comparison, the discussion of these observations is included in the discussion of the chemical results of the investigation which occupies a later paragraph.

On 28th January, 1930, the work of removing the root-systems from the containers was begun. After placing a container in a horizontal position, three sides were lifted off, leaving the intact soil-column and its included root-system on the fourth side. The first and second feet of the column were then sawn off and the blocks of soil were placed in tins of fresh water. After soaking for some hours the contents of the tins were dumped on a wood and wire screen, and the roots, after as

much soil as possible had been hosed away, were forwarded for analysis in respect of their arsenic content.

Wooden container with one side open showing Hoary Cress roots.

DISCUSSION OF THE RESULTS OBTAINED FROM THE POT EXPERIMENTS.

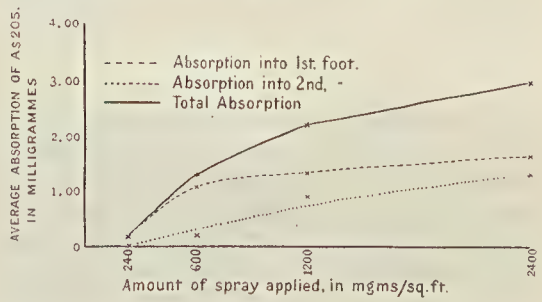
1. The influence of the amount of arsenic pentoxide applied to the plant on the amount absorbed by the plant.

Under this heading the results obtained from the "Amount applied" tests only are discussed. In Table No. 8, the average absorption of arsenic pentoxide, expressed both as milligrammes of arsenic pentoxide and as a percentage of the dry weight of the root-system, is given for the first and second foot of the root-system, together with their respective totals and averages, for the varying amounts of arsenic pentoxide applied. For reasons discussed later, only low-soil moisture containers are dealt with in this table.

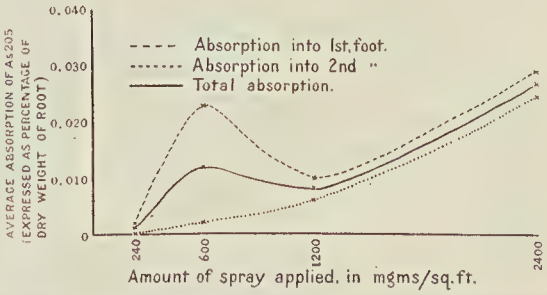
TABLE No. 8.—SHOWING THE INFLUENCE OF THE AMOUNT OF SPRAY APPLIED TO THE PLANT ON THE ABSORPTION OF THE SPRAY WITHIN THE FIRST 2 FEET OF ROOT-SYSTEM.

Amount of Spray Applied.	Average Absorption of Arsenic Pentoxide.					
	1st foot.	2nd foot.	Total.	Average Percentage of Dry Weight of Root-system.		
				1st foot.	2nd foot.	Mean.
Mgms/sq. ft..	Mgms.	Mgms.	Mgms.	%	%	%
240	0·18	..	0·18	0·002	..	0·001
600	1·09	0·18	1·27	0·023	0·002	0·012
1,200	1·32	0·86	2·18	0·010	0·006	0·008
2,400	1·63	1·30	2·93	0·029	0·024	0·026

Graphs Nos. 5 and 6, which embody the information in Table 8, show that the single-plant experiments have provided striking confirmations of the conclusions previously drawn from the results of the field work.



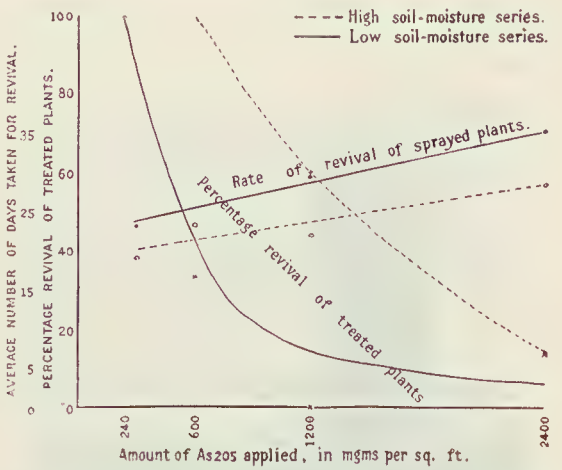
Graph 5.—Showing the influence of the amount of spray applied on the absorption of spray within the first two feet of root system (expressed as milligrammes of As_2O_5).



Graph 6.—Showing the influence of the amount of spray applied on the absorption of spray (expressed as a percentage of dry weight of root) within the first two feet of root system.

A glance at Graph No. 5 is sufficient to show that, so far as the absorption of the arsenic pentoxide is concerned, whether in the first or second foot of root-system or in the aggregate of those two sections, the most economical spraying is in the region of 1,000 milligrammes per square foot, a conclusion which had been already arrived at by means of field sprayings. The close agreement between the results of the counts made on the field plots according to the "percentage shoot-kill" method previously described and the results of the chemical analyses of the roots also confirms the tentative results obtained by the former method of evaluating spray efficiency. The "percentage shoot-kill" method was adopted only because of the impossibility of differentiating between individual plants in the field; it is therefore of interest to compare the results obtained by this method with the results obtained from the single plants in regard to the rate and percentage of revival of plants sprayed with varying amounts of arsenic pentoxide. Table 9 and Graph 7 show the figures obtained from observations of the treated plants up to 27th November, 1929.

From the graph showing the percentage revival of plants treated in the low soil-moisture section it appears that sufficient correlation exists between the diminution of shoot-production and the actual deaths of plants due to the application of arsenic pentoxide spray to justify the reliance which has been placed on the "percentage shoot-kill" figures in the analysis


High soil-moisture series.
Low soil-moisture series.
AVERAGE NUMBER OF DAYS TAKEN FOR REVIVAL.
PERCENTAGE REVIVAL OF TREATED PLANTS.
Rate of revival of sprayed plants.
Percentage revival of treated plants.
Amount of As2O5 applied, in mgms per sq. ft.

Graph 7.—Showing the influence of amount of spray applied per plant on the rate and percentage revival.

of relative efficiencies of field sprayings. It will also be noted that the most economical spraying is in the region of 1,000 milligrammes per square foot, as before. Although the rate of revival of sprayed plants is slower with applications above 1,000 milligrammes, the slight decrease in the percentage revival due to the heavier sprayings is far out-weighed by the additional cost entailed.

Returning to Graph 6, an unexpected feature is observed in that the percentage of arsenic pentoxide absorbed, calculated on the basis of the dry weight of root, shows a peak at 600 mgm. per square foot, followed by a

TABLE 9.—SHOWING THE RATE AND PERCENTAGE OF REVIVAL OF HOARY CRESS PLANTS SPRAYED WITH VARING AMOUNTS OF ARSENIC PENTOXIDE UNDER HIGH AND LOW SOIL-MOISTURE CONDITIONS.

Treatment.	High Soil-moisture.				Low Soil-moisture.			
Mgms. As_2O_5 per sq. ft.	Number Sprayed.	Number Revived.	Percentage Revival.	Average Time of Revival (days).	Number Sprayed.	Number Revived.	Percentage Revival.	Average Time of Revival (days).
			%				%	
240	6	6	100	19	6	6	100	23
600	6	6	100	23	6	2	33	30
1,200	5	3	60	22	5	0	0	..
2,400	7	1	14	28	7	1	14	35
NOTE.—In this section *all* plants revived by 1st February, 1930.					NOTE.—No other revivals.			
2,400 (leaves off)	6	4	67	24	6	1	17	28
2,400 (leaves and epidermis off)	6	3	50	28	6	1	17	28
2,400 (humidity tests) ..	3	..	..	..	3	1	33	21

pronounced decrease at 1,200 mgm. per square foot. This type of graph is at variance with that shown in Graph 5. No satisfactory explanation of this is as yet available, but there are reasons for believing that the expression of the absorption in terms of milligrammes of arsenic pentoxide is a more satisfactory method. For example, the degree to which the attack of the fungus *Aspergillus glaucus* (which invariably follows closely on the death of roots as a result of the penetration of arsenic pentoxide) on the starch reserves has proceeded at the time of analysis of the root has a marked influence on the dry weight of the root, and hence on the percentage calculated from that dry weight. Further, if, as this series of tests indicates, the absorption and penetration of arsenic pentoxide spray is governed in the main by the joint influences of the amount of spray applied to the plant and the excess of transpiration over the absorption of water by the roots, the total area of leaf and stem surface would seem of more importance than the weight of the root-system.

2. The influence, on the penetration of the absorbed arsenic pentoxide, of the amount applied.

In two plants, the root-systems of which were analysed in full in 6-inch sections, it was found, as shown in Table 10, that the penetration of the herbicide had extended throughout the entire plant, but a large number of the sprayed plants were not affected to such a marked extent. In Table 11 the number of plants treated in the various experimental sections is contrasted with the number in which no penetration into the second foot of root-system took place, and it is apparent from this table that the amount of spray applied exercises a marked influence on penetration, since with sprayings of 240 mgm. per square foot no plant was affected beyond the first foot.

Table 10.—Showing the Absorption and Penetration of Arsenic Pentoxide into the Root-systems of Two Hoary Cress Plants.

Depth of Root-system.	Milligrammes of Arsenic Pentoxide Present.	
	Container No. 63.	Container No. 82.
	Mgm.	Mgm.
0 inches to 6 inches ..	0·52	0·23
6 „ 12 „ ..	1·15	0·09
12 „ 18 „ ..	0·90	0·06
18 „ 24 „ ..	0·74	0·09
24 „ 30 „ ..	0·81	0·09
30 „ 36 „ ..	0·79	0·09
36 „ 42 „ ..	0·46	0·09
42 „ 48 „ ..	0·31	0·07
48 „ 54 „ ..	0·24	0·06
54 „ 57 „ ..	0·07	..

Note.

Plant 63 sprayed with 40 c.c. 6 per cent. As_2O_5 solution on 25th October, 1929.

Plant 82 sprayed with 40 c.c. 6 per cent. As_2O_5 solution on 18th October, 1929.

Table 11.—Showing the Penetration of Arsenic Pentoxide into the Root-systems of Hoary Cress Plants Variously Sprayed.

Treatment.	Number of Plants Treated.	Number of Plants showing no Penetration into Second Foot.
Mgms. As_2O_5 per sq. ft.		
240	6	6 equals 100 per cent.
600	6	2 „ 33 „
1,200	5	0 „ 0 „
2,400	7	2 „ 29 „

3. The influence, on the absorption and penetration of arsenical spray, of the weather conditions preceding spraying.

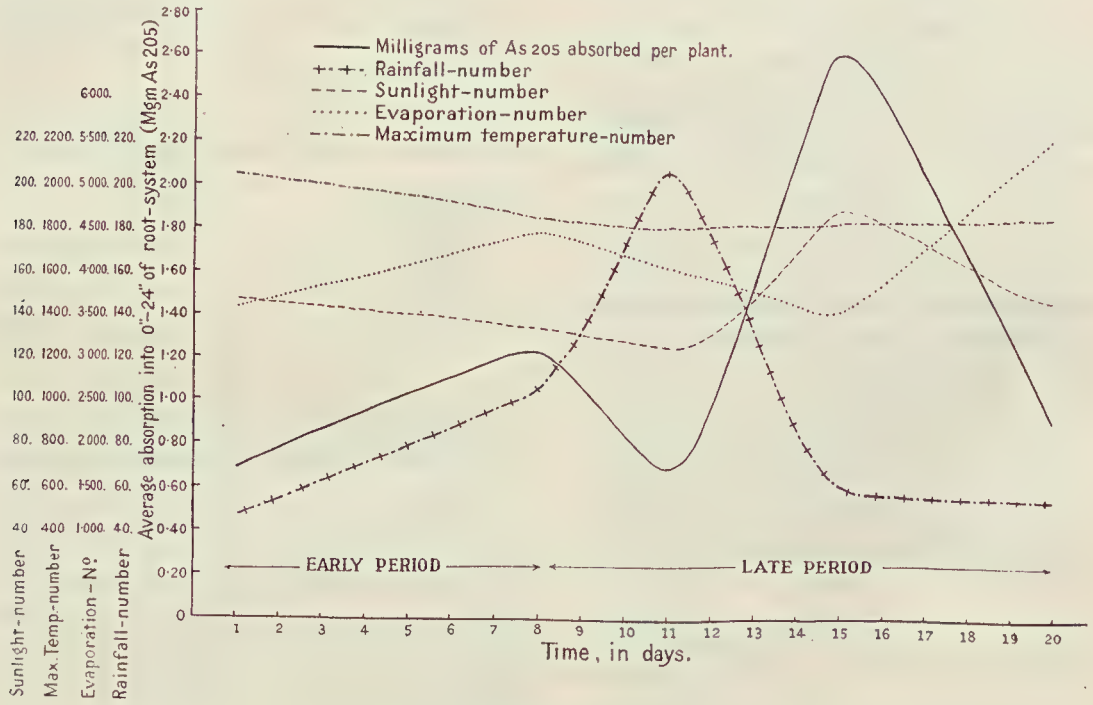
Although only a limited time elapsed between the commencement and termination of the tests on the single plants, it is considered that sufficient evidence has been obtained in regard to the influence of the factors of sunlight, rainfall, and evaporation to support strongly the conclusions arrived at through the medium of the field sprayings. Following the method described in detail in an earlier paragraph, of calculating "rainfall-numbers," values for the various weather factors have been arrived at for the weeks previous to the various dates on which sprayings of the single plants were carried out, and these values are shown in Graph 8 in comparison with the average absorption of arsenic pentoxide in milligrammes per plant.

In connexion with Graph 8, it will be noted that, while an increase in the rainfall-number was associated with increased spray-absorption in the early part of the test period, in the later period the increasing rainfall-number is associated with (and is considered to be a

main cause of) a decrease in the average absorption per plant of arsenic pentoxide. This is followed by a decrease in the rainfall-number associated with increased absorption. The disturbance of the "normal" relationship which apparently exists between rainfall in the week preceding spraying and the extent to which absorption may take place is attributed, in the early period of the tests, to the influence, antagonistic to that of rainfall, of increasing evaporation, although it cannot be maintained that the influence of evaporation

4. The influence, on spray efficiency, of the soil-moisture available to hoary cress plants at the time of spraying.

As previously stated, critical work in this connexion was not possible, but it was arranged that comparisons should be secured between plants treated under conditions of high soil-moisture and low soil-moisture respectively at the time of spraying. In Table 9 and Graph 7 comparison is made between the rate and percentage revival of treated plants in these sections. It was originally intended that the



Graph 8.—Showing the influence of rainfall, sunlight, evaporation, and temperature on spray-absorption.

is very marked in the later period. Another interesting feature is the coincidence of a high "sunlight-number" with the maximum average absorption encountered throughout the test period. In view of these facts, it can only be concluded that the weather conditions preceding spraying influence sprays absorption by virtue of their influence on the processes of transpiration and photosynthesis—a conclusion in agreement with that already reached on analysis of the results of field tests.

treated plants of both sections should be analysed to determine the absorption and penetration of the arsenical spray, but since the whole of the high soil-moisture plants had produced new shoots by February, 1930, it was considered unnecessary to devote any further time and attention to them, since under no treatment had the absorption been sufficiently large to inhibit growth. In the low soil-moisture section, however, a number of plants were unable to produce new shoots, and

a possibility existed that these plants were those into which a large amount of herbicide had been absorbed. The analyses of these plants were therefore made to ascertain whether the inhibition of growth was due to the absorption of arsenic pentoxide or to the lack of soil-moisture.

Work by Crafts and Kennedy on *Convolvulus arvensis* ("Plant Physiology," Vol. 5, No. 3, 1930) gives the lethal concentration for that plant as 0.02 per cent. of the dry weight of tops and 0.0003 per cent. of the dry weight of roots. Assuming this figure to be applicable to the case of hoary cress, applications as low as 600 milligrammes per square foot will be seen from Table 8 to have, on the average of a number of plants, effected a lethal concentration in the first 2 feet of the root-system. As the complete article by Crafts and Kennedy is not available (the above data having been secured from a summary in the *Experiment Station Record*, Vol. 64, No. 1, January, 1931) no figures showing the actual absorption in milligrammes are to hand for comparison with the amounts shown in Table 8. It is considered, however, that the percentage of dry weight of roots method of expressing absorption in hoary cress plants, as compared with Crafts and Kennedy's results, provide sufficient evidence of the presence of lethal concentrations of arsenic in the root-system to justify the use of Table 9 and Graph 7 in the evaluation of the influence of soil moisture at the time of spraying on the efficiency of the spray.

Reference to this graph, showing the rate and revival of the treated plants under the extremes of soil-moisture, emphasizes the increase in spray efficiency which follows on a reduction in the soil-moisture available to the plants. Firstly, the efficiency of the spray under high soil-moisture conditions with applications of 2,400 mgm. per square foot is equalled by that of applications of 1,200 mgm. per square foot under low soil-moisture conditions. Secondly, the time of revival of plants which do not receive a lethal dosage to the necessary depth of the root-system is much less under high soil-moisture conditions. Thirdly, the increase in the time of revival with increasing applications of spray proceeds at a more rapid rate in the low soil-moisture series.

5. The influence, on spray efficiency, of mechanical injury to hoary cress plants immediately before spraying.

In Table 12 the amounts and percentages of arsenic pentoxide absorbed by the plants subjected to mechanical injury before spraying are compared with the amount and percentage absorbed, under average conditions, by uninjured plants. The high absorption shown by the first foot of root-system of the defoliated plants, and the low absorption by the second foot, in comparison with the uninjured plants, is a striking feature, and immediately suggests that a high absorption would be secured by this method except for the small area of contact between the spray solution and the plant. It is unlikely that the wounds caused by stripping off the leaves are important as a means of direct absorption into the vascular system, so increasing the amount absorbed, since extensive wounding, in addition to defoliation, tended to reduce the absorption to the same level as that of the uninjured plants. The inference then is that the stem-surface per unit area is much more efficient than the leaf-surface as an absorbing organ for arsenical spray, but that better penetration of the arsenical spray is obtained with uninjured plants of which both these surfaces act as absorbing organs. Since for practical control of hoary cress a good penetration of the arsenic is essential, the mutilation of the plants before spraying is therefore of little value.

TABLE 12.—SHOWING THE INFLUENCE OF MUTILATION BEFORE SPRAYING ON THE ABSORPTION OF ARSENIC PENTOXIDE BY HOARY CRESS PLANTS.

Treatment. (2,400 mgms. As_2O_5 per sq. ft.)	Absorption of Arsenic Pentoxide.			
	Milligrammes absorbed by—		Percentage of Dry Weight of Root-system.	
	1st foot of Root-system.	2nd foot of Root-system.	1st foot.	2nd foot.
Uninjured ..	1·63	1·30	0·009	0·024
Defoliated ..	2·79	0·49	0·037	0·005
Stem scraped after Defoliation ..	1·99	0·47	0·018	0·005

6. The influence of the humidity of the air on spray efficiency.

The result of this test was unsatisfactory, as shown in Table 13. Had a sufficiently large number of plants been tested under the conditions of humidity previously described, it is possible that the reaction of continued humid conditions on spray efficiency would have been evidenced. An analysis of the influence of humidity of the air on the efficiency of field sprayings was not attempted, because of the large number of wet and dry bulb thermometer readings which would have been necessary on account of the variability of this factor. For the present it can only be surmised that the relative humidity of the air, if a factor influencing the absorption and penetration of the arsenic pentoxide, is not important in the same degree as the incidence of rainfall and the amount of spray applied.

TABLE 13.—SHOWING THE INFLUENCE, ON THE ABSORPTION OF ARSENIC PENTOXIDE SPRAY, OF A CONTINUED HIGH RELATIVE HUMIDITY OF THE AIR.

Treatment. (2,400 mgms. As_2O_5 per sq. ft.)	Absorption of Arsenic Pentoxide into Root-system.			
	First Foot.		Second Foot.	
	Mgm.	%	Mgm.	%
High humidity (*a*)	0·10	0·008	..	..
(*b*)	2·90	0·020	0·70	0·004
Control ..	0·70	0·004	..	..

Since a high humidity of the air tends to restrict transpiration, it would be expected to operate against a high absorption and penetration of arsenic. According to Crafts and Kennedy, however, the condensation of dew on the leaves would cause a prolonged exposure to the action of the spray, and so increase the absorption.

Summary of results of single-plant sprayings, 1929.

1. The spraying which most satisfactorily combines efficiency and economy under average conditions is one in the region of 1,000 milligrammes of arsenic pentoxide per square foot.

2. The most favorable weather conditions for spraying are those under which the processes of transpiration and photosynthesis proceed at a rapid rate.

3. A low moisture content of the soil in which hoary cress plants are growing is favorable to a high absorption and penetration of the arsenic pentoxide spray.

4. Nothing is gained, from the point of view of spray-efficiency, by mutilation of the plants before spraying.

5. The relative humidity of the air, except perhaps in so far as it affects the process of transpiration, is not an important factor governing spray-efficiency.

SOME REASONS WHY ARSENICAL SPRAY DOES NOT GIVE COMPLETE CONTROL OF HOARY CRESS.

While it is claimed that the use of arsenic pentoxide solution as a spray, under the favorable conditions previously outlined, may effect a very good control of hoary cress patches for a period of at least twelve months, no case has yet been noted in which 100 per cent. control for a period of twelve months from the time of spraying has been obtained. Some reasons for this are at once apparent from the conclusions drawn from the single-plant tests, particularly in regard to transpiration and soil-moisture. Even in a weed-patch of small size, no uniformity in regard to the size of aerial portions obtains, so that the water deficit, due to transpiration, probably varies greatly from plant to plant of the patch. Further, the variation in soil-moisture from plant to plant may be large. Under these conditions, it is to be expected that a number of the sprayed plants are not subjected to conditions of soil-moisture and transpiration which are favorable to the action of the spray, and complete control cannot be effected. A third factor, and one of great importance, is that of plant-linkage, as shown in Diagram 4.

The plant shown in this diagram was removed from a plot sprayed with arsenic pentoxide solution, measurements of the extent of the movement of the herbicide within the root-system being made possible by the attacks of *Aspergillus glaucus*. Entering through shoots at "A," the poison travelled a total distance, in the main root-system and in the secondary root-system "B–C," of 57 inches, but the

maximum penetration in the primary system was only 15 inches, while living portions of the secondary system remained at a depth of 6 inches below the soil surface. Despite the extensive translocation of herbicide which took place, the control obtained was only of a temporary nature. The frequency with which examples of good absorption accompanied by poor penetration were met with argued that this phenomenon was a major cause of failure of arsenical sprayings. This is especially the case with a type of hoary cress plant which, on account of the shape and size of the leaf, may be conveniently termed the "narrow-leaf" type. The root-system of a "narrow-leaf" hoary cress plant is characterized by a higher development of the "rhizomatous" condition than is the case with the "broad-leaf" type, the root-system of which has been dealt

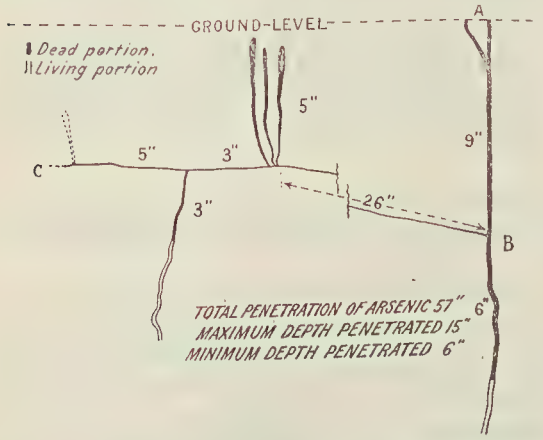


Diagram 4.—Showing the course travelled by absorbed arsenic pentoxide in a Hoary Cress plant of "narrow leaf" type, 5th January, 1929.

with in an early paragraph, and as a consequence the efficiency of the spray is considerably decreased.

Except in the case of very small shoots in the "rosette" stage, it is unlikely that the deposition of insufficient spray on the plant will occur. Precautions were taken, as described, to ensure uniform spraying per unit area of plot, and tests were subsequently made to determine the variation in the amount of herbicide deposited on plants of varying stages of growth and maturity. The figures obtained from these tests are given in Table 14, and show that under field conditions the amount of spray received per plant shoot is not greatly influenced by the stage of growth of the shoot.

TABLE 14.—SHOWING THE RELATIVE AMOUNTS OF SPRAY RECEIVED BY PLANT SHOOTS OF VARYING GROWTH STAGE.

Description of Plant-shoot.	Amount of Spray Received by Shoot (in mgms. As_2O_5). (Average of ten Plant-shoots.)
Small rosette (R1)	7·3
Shoot 3 inches high, not yet flowering (A1)	11·6
Shoot 3 inches high, flowering, flowers not opened (F1a)	12·6
Shoot 6 inches high, flowering, flowers not opened (F2a)	16·3
Shoot 6 inches high, seeding (S2) ..	14·0
Shoot 9 inches high, seeding (S3) ..	14·8
Shoot 12 inches high, seeding (S4) ..	14·2
Shoot 15 inches high, seeding (S5) ..	13·5

NOTE.—Plot sprayed at rate of 125 gallons per acre with 6 per cent. solution.

SUMMARY.

1. The root-system of "hoary cress" (*Lepidium draba*, L.) consists of a deeply-penetrating main root from which a small number of "lateral" roots arise at a depth of 12 to 18 inches. Fibrous roots arise at frequent intervals along the main and "lateral" roots. Horizontally-spreading roots (often called rhizomes) contribute greatly to the rapid spread of the weed. Any portion of the root-system may give rise to a new infestation if placed in a favorable environment.

2. Cultivation, if carried out at intervals of not more than fourteen days, and persisted with for a period of not less than two years, completely eradicated hoary cress under Werribee conditions.

3. Applications of salt (NaCl) at varying rates and by a number of methods was found ineffective as a means of control of hoary cress.

4. Of the sprays tested, solutions of arsenic pentoxide proved the most efficient in the control of hoary cress.

5. The arsenic pentoxide spray controlled the weed by virtue of its absorption into, and translocation in, the root-system.

6. Under favorable conditions, the root-system was killed to a depth of 2 feet or more. From this depth below the ground surface, the hoary cress plants were unable to produce new

shoots capable of reaching the surface, forming green leaves, and re-infesting the soil.

7. The conditions found most favorable to the "remote penetration" of arsenic pentoxide spray were those producing a high rate of transpiration and photosynthesis.

8. The efficiency of the spray was found to increase with increasing amounts applied per unit area of plot, but beyond an application of 1,000 milligrammes per square foot the slightly increased efficiency of the spraying was not commensurate with the increased cost of control. Under very favorable weather conditions the above rate of spraying may be materially reduced without loss of efficiency.

9. For the present, at Werribee, the especially favorable weather conditions may be broadly defined as a week of dry hot weather preceding the spraying.

10. Falls of rain prior to spraying depress the efficiency of the spraying in direct ratio to their magnitude and the shortness of the interval between their incidence and the time of spraying.

11. Other things being equal, the efficiency of the spraying increases with decrease of soil-moisture available to the sprayed plants at the time of spraying.

12. Consideration of the influences exerted on spray-efficiency by the weather conditions preceding spraying and the soil-moisture at the time of spraying leads to the conclusion that the absorption and translocation of the arsenical spray within the root-system of the plant is directly due to the establishment within the vascular system of the plant of a "water-deficit" or "sub-atmospheric pressure" as a result of the excess of water lost through transpiration over that absorbed from the soil per medium of the root-hairs.

13. By means of single-plant experiments, confirmation of the results in regard to the influence of the amount of spray applied, and the weather conditions prior to spraying, was obtained.

14. A method of evaluating the relative efficiencies of different sprayings, based on the percentage shoot-kill still apparent at twelve months after spraying, was applied in field tests, and confirmation of the suitability of this method for field work was obtained from single-plant tests.

15. The field counts of the percentage shoot-kill at three, six, and twelve months respectively after spraying showed the fallacy of basing any conclusions in regard to the efficiency of the spray on any counts made earlier than twelve months after spraying.

16. Variations in the rate of transpiration, and in the amount of available soil-moisture, from plant to plant are considered major causes of the failure of arsenic pentoxide spray to effect complete control of all plants occurring in the sprayed area.

17. Arsenic pentoxide spray was found to be greatly reduced in efficiency when the sprayed plants were of a type showing great development of horiontally-spreading roots ("rhizomes"). The depth of penetration in plants of this type was found to be small, although the actual distance travelled in the root-system by the absorbed herbicide was often great. Above ground this type of hoary cress plant may be recognized by the relative narrowness of its leaves.

18. The tests as yet have not provided a remedy that may be applied over large areas, but where the weed is not widely spread effective control is possible, provided the methods are applied as set out below.

Methods to be followed in the eradication of the weed occurring in small patches on the farm.

Where the weed occurs in small patches two methods are available to prevent its spreading to the remainder of the area, namely, the cultivation method or the use of arsenic pentoxide spray. The choice of method will be largely determined by the existing conditions on the particular farm or field concerned. The two methods are as follow:—

(A) *Arsenic Pentoxide Spray Treatment.*—Isolate the patches of weed by pegging out, or any other convenient method. Allow a good growth of the weed to develop; then, following a week of hot, dry weather, spray with 6 per cent. arsenic pentoxide solution at the rate of 120 gallons per acre (approximately one-tenth quart to the square yard). No further treatment should then be necessary until after a lapse of twelve months, when the spraying should be repeated on plant shoots which have re-appeared above the surface. The cost of this "spot" treatment in the second year should be low. The cost of material for the first spraying, allowing 6d. per lb. for arsenic pentoxide, should be in the region of £1 16s. per acre. For the treatment of small patches, as recommended, the

cost of spraying should be a few shillings. For example, the cost of material for spraying a patch 10 yards by 10 yards in area is only 9d. Using a small bucket spray outfit of the type commonly used for garden spraying, one kerosene tin full of spray will cover two patches of this size (10 yards by 10 yards) at the required rate of spraying.

(B) *Treatment by Cultivation.*—If, because of the risk of poisoning stock by the use of the arsenical spray, the cultivation method is preferred, the patches should be marked out as before by pegging, the pegs preferably being put in a yard or two beyond the edge of the patch. At intervals of not less than fourteen days the patches should be so cultivated or hoed that no roots are carried on to clean ground. These cultivations should be carried out for a period of two years. If a patch is passed frequently in the course of the usual routine of the farm, and a hoe is left handy to the patch, the plants may be hoed out as soon as they appear. Persistent efforts along these lines will be rewarded by a complete eradication of the weed. If, however, the patch is hoed or cultivated and a long interval elapses before the next hoeing or cultivation both operations will be valueless, since the storage reserves of the plants may be augmented during that interval rather than depleted. Where regular cultivation or arsenic pentoxide spraying is not carried out the patches should be isolated by pegging out, and left undisturbed except to prevent the formation of seed.

Under irrigation conditions, it has been observed frequently that, to a large extent, the suppression of the weed may be brought about by proper management of the lucerne or pasture. Under conditions of adequate manuring and watering and good management in regard to grazing, &c., the competition of the lucerne, clovers and grasses will greatly restrict the development of the weed.

Acknowledgment.—All chemical analyses in connexion with these tests were carried out at the Departmental Chemical Laboratory under the supervision of the Agricultural Research Chemist (W. R. Jewell, M.Sc.).

Egg-Laying Competition

(*Continued from page 501.*)

DUCKS.

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Section A.—Teams of Six Birds, Single Tested.			
1st Prize.—Champion Certificate.			
Broadleigh Egg Farm, Spring Vale (Khaki Campbell)	634	..	634
2nd Prize.—Government Certificate.			
M. G. Leech, Campbellfield .. (Khaki Campbells)	455	..	455
Individual Birds.			
Equal 1st Prize.—Champion Certificate.			
1. Broadleigh Egg Farm, SpringVale (Khaki Campbell)	118	..	118
2. Broadleigh Egg Farm, SpringVale (Khaki Campbell)	118	..	118
3. M. G. Leech, Campbellfield .. (Khaki Campbell)	118	..	118

Ducks—*continued.*

Name and Address.	Total Eggs.	Under-weight.	Total First Grade Eggs.
Individual Birds—*continued.*			
2nd Prize.—Government Certificate.			
Broadleigh Egg Farm, Spring Vale (Khaki Campbell)	115	..	115
Section B.—Individual Birds, Single Test.			
1st Prize.—Champion Certificate.			
N. W. Kerr-Clark, Mornington .. (Khaki Campbell)	121	..	121
Equal 2nd Prize.—Government Certificate.			
1. N. W. Kerr-Clark, Mornington (Khaki Campbell)	117	..	117
2. E. Clarke, Mornington .. (Khaki Campbell)	117	..	117

Standard Herd Records

1930-31

COWS IN ORDER OF MERIT

Note.—In the following list are published the names of the cows and heifers that, with allowances yielded more than 500 lb. butter fat. The annual report and herd records were published in the September issue of this Journal.

MATURE COWS. (Over 5 Years at time of calving.) 350 lb. Standard

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Willow Park Cherry ..	W. K. Atkinson ..	Milking Shorthorn ..	17,789	4·09	729·37	Havelock of Dabalara
2	Ipomea of Swansea ..	F. P. Stephens ..	Jersey ..	12,323	5·88	724·51	Pearl's Twylish of Ferntree Vale
3	St. Albans Ina Sylvia ..	J. Padgett	Friesian ..	18,352	3·84	705·01	Echo Sylv King Pontiac
4	Victoria Lean Patch ..	Department of Agriculture	,,	19,682	3·55	699·58	Victoria Jo Patch
5	Victoria Freemartin ..	Department of Agriculture	,,	20,641	3·20	659·68	Victoria Songboy
6	Westmere Oakwood Duchess	J. Plattfuss	,,	19,031	3·43	653·46	Dominion Oakwood
7	Werribee Fancy Madeira ..	J. V. M. Wood ..	Jersey ..	11,285	5·73	646·98	Masterpiece (Imp.)
8	Narcissus of Springhurst ..	J. D. Read	,, ..	11,375	5·63	640·17	Starbright's Prince of Glen Iris
9	Myra of the Wattles ..	N. H. Enders ..	,, ..	12,699	4·99	633·24	Laddie 2nd of Banyule
10	Ewelme Girl	C. Chitty	,, ..	9,371	6·72	629·50	Werribee Wyandotte's Fancy
11	Willow Park Camelia ..	W. K. Atkinson ..	Milking Shorthorn	14,508	4·24	614·73	Count of Willow Park
12	Willow Park Moss Rose ..	,, ...	Milking Shorthorn	14,745	4·15	612·18	Havelock of Dabalara
13	Peggy of Parkview ..	J. McDougall ..	Jersey ..	11,387	5·30	603·51	Toney of Fairview
14	Halecote Opera Girl ..	Smith and Son ..	Friesian ..	19,524	3·08	602·30	Victoria Songboy
15	Lady Marge 5th of Jerseyholm	T. Harvey	Jersey ..	9,485	6·35	601·91	Alliance 3rd of Jerseyholm
16	Burnbank Bainfield Patch ..	A. E. Enders	Friesian ..	17,313	3·46	599·83	Rock Patch
17	Seville of Kelburn ..	N. H. Enders.. ..	Jersey ..	10,380	5·77	598·62	Noble Lad of Kelburn
18	Bonnay Jess-amine ..	E. J. Vagg	,, ..	9,969	5·99	596·67	Mona's Duke of Woorayl
19	Flower of Jersey Hill ..	R. Stockdale	,, ..	9,500	6·08	577·47	Butterwinks of Jersey Hill
20	Carrie 3rd of Queen's Vale ..	W. H. Hurry	,, ..	9,492	6·08	576·82	Linda's Record 7th of Kingsvale
21	Victoria Songbell	Department of Agriculture	Friesian ..	19,089	2·99	571·21	Victoria Songboy
22	Molly 18th of Banyule ..	N. H Enders ..	Jersey ..	10,449	5·44	567·92	Wotton Airman
23	Tomato of Springhurst ..	J. D. Read	,, ..	11,052	5·13	567·23	Alloy of Banyule
24	Purity of Hazeldale ..	A. J. Mapleson ..	,, ..	10,969	5·17	567·16	Dinkum of Banyule
25	Gladiolus of Springhurst ..	J. D. Read	,, ..	10,413	5·42	563·97	Arcadia's Choice of Tarnpirr
26	Koomangoonony Lady Diana	Wl J. Clark	,, ..	9,855	5·60	551·57	Nipheto's Twylish of Willis Vale
27	Tarrawarra 56	J. Plattfuss	Friesian ..	20,277	2·70	547·48	Count Tago ..
28	Duchess 2nd of Glenleigh ..	J. E. Chadderton ..	Jersey ..	8,322	6·57	546·80	Master Moll of Banyule
29	Bunty 2nd of Coliban ..	A. A. Broad	,, ..	11,319	4·82	545·99	Carrie's Boy of Coliban
30	Aberdour Ranee	J. V. M. Wood ..	,, ..	8,376	6·52	545·83	Lord 2nd of Bruce Vale
31	Air Maid of the Falls ..	R. M. Chirnside ..	,, ..	10,238	5·32	545·03	Air Pilot of Banyule
32	St. Albans Lady Echo ..	I. Padgett ..	Friesian ..	14,653	3·72	544·92	Echo Sylv. King Pontiac
33	Lady Veeman Homestead ..	Padgett I.	,, ..	14,123	3·85	543·81	North Star Joe Homestead
34	Alsyke 2nd of Springhurst ..	J. D. Read	Jersey ..	9,174	5·90	541·13	Arcadia's Choice of Tarnpirr
35	Rosebud 2nd of Paradise ..	J. A. Huffer	,, ..	9,833	5·49	539·67	Werribee Northern Larkspur Fancy
36	Greenvale Piebe Patch ..	J. Plattfuss	Friesian ..	16,136	3·34	538·81	Victoria Rose Patch
37	Nightshade 2nd of Springhurst	Foster Bros.	Jersey ..	8,349	6·44	537·73	Arcadia's Choice of Tarnpirr
38	Miss Guy of Tarnpirr ..	F. Trevaskis	,, ..	9,202	5·83	536·07	Mythic's Choice of Tarnpirr
39	Eileen 2nd of Clarendon Eyre	P. J. Maloney ..	,, ..	8,924	5·97	532·96	Lotina Larkspur's Twylish
40	Norma of Terara	L. J. Herd	,, ..	10,305	5·17	532·89	Carnegie of Terara
41	Daisy of Linga Longa ..	J. M. Hopkins ..	,, ..	9,819	5·41	531·62	Arcadia's Choice of Tarnpirr
42	Honesty of Kameruka ..	A. Cox	,,	9,710	5·46	530·41	Silver King
43	Mythic of Beverley ..	W. H. Atherton ..	,,	9,356	5·66	529·48	Rosella's Lad of Kingsvale
44	Chevy 13th of Melrose ..	H. Cowling	,, ..	9,195	5·75	528·71	Golden Fern's Viscount
45	Madonna of Aberdour ..	J. V. M. Wood ..	,, ..	9,548	5·54	528·61	The Laird of Aberdour
46	Tressie of Sunnyford ..	J. V. M. Wood ..	,, ..	8,350	6·32	527·43	Sparkle's Chief
47	Verbena of Glen Valley ..	J. A. Huffer	,, ..	9,194	5·70	524·04	Jewel 3rd Moroccoo's Fox
48	Lily 2nd of the Valley ..	Mrs. L. Lowing ..	,, ..	10,496	4·97	522·02	Foxglove of the Valley
49	Mythic of Beverley ..	W. A. Atherton ..	,, ..	8,733	5·97	521·09	Rosella's Lad of Kingsvale
50	Wynette of Somerville ..	J. Hutchinson and Sons	,, ..	10,271	5·05	518·72	Heroic of Somerville
51	Werribee Island Fancy Madeira 2nd	J. P. Chirnside ..	,, ..	9,359	5·52	516·82	Island Butter King
52	Jessie of Meridale	A. J. Mapleson ..	,, ..	8,838	5·84	516·15	Big Chief of Glen Iris
53	Maitland's Petal 2nd of Elouera	Clyne J.	,, ..	9,431	5·47	515·57	Double Twylish of Elouera
54	Peggy of Belgonia ..	N. H. Enders ..	,, ..	10,205	5·00	510·39	Prince of Belgonia

MATURE COWS (OVER 5 YEARS AT TIME OF CALVING) 350 LB. STANDARD.—*continued.*

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
55	Staghorn Fox's Clementine 4th	F. Bidgood	Jersey ..	8,939	5·68	507·79	Madeira's King of Staghorn
56	Linda 63rd of Kings Vale ..	R. G. Gay	,, ..	10,292	4·93	507·66	Rosella's V. C. of Kings Vale
57	Miss Linacre 2nd of Boorcne	McNabb and Son ..	,, ..	10,698	4·74	506·87	Arcadia's V.C. of Wooringa
58	Noorat Sunshine	Mrs. A. Black ..	,, ..	9,474	5·34	505·65	Best Choice of Tarnpirr
59	Tulip 2nd of Springhurst ..	J. D. Read	,, ..	9,861	5·12	504·40	Attraction of Springhurst
60	Bolero Sylvia Grietje ..	J. Van Brummelen ..	Friesian ..	15,725	3·20	503·50	Burnbank Inka Sylvia's Lad
61	Clarionette of Tavistock ..	A. Cox	Jersey ..	8,046	6·25	502·62	Audrey's Prince of Banyule
62	Betty of Lone Gum ..	E. Day	,, ..	9,248	5·42	501·21	Nobility 3rd
63	May Song of Warenda ..	W. J. Clark	,, ..	8,969	5·59	501·11	Oriel of Warenda
64	Silver Maid 2nd of Glenwood	J. Unthank	,, ..	8,168	6·13	501·01	Lotus King of Staghorn
65	Koomangoonony Lady Diana	W. J. Clark	,, ..	9,542	5·24	500·39	Nipheto's Twylish of Willis Vale
66	Tecoma of Springhurst ..	J. D. Read	,, ..	9,809	5·10	500·14	Cossock of Springhurst

SENIOR 4 YEAR OLD (Between 4½ and 5 Years) 325 lb Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Air Girlie of the Falls ..	R. M. Chirnside ..	Jersey ..	10,421	5·82	606·99	Air Pilot of Banyule
2	Darenth Black Rose ..	Smith and Sons ..	Friesian ..	16,272	3·59	583·88	Springfield Champion
3	Nardoo of Springhurst ..	J. D. Read	Jersey ..	9,029	6·12	552·95	Starbrights' Prince of Glen Iris
4	Aveley Silvermine.. ..	W. P. Rogen	,, ..	9,005	5·59	537·26	Werribee Fancy's Butter King
5	Wompini Duchess ..	T. M. Noble and Son ..	,, ..	9,695	5·42	525·27	Werribee Masterman
6	Glen Elgin Jessie Segis ..	J. Plattfuss	Friesian ..	17,826	2·91	517·95	Halecote Segis Songboy
7	King's Vale Brunette 21st ..	S. H. Masters ..	Jersey ..	10,997	4·69	515·72	Linda 5th V.C. of King's Vale
8	Fairhope Magnet	T. J. Scott	,, ..	7,488	6·84	512·23	Merry Boy of Ilford
9	Strathey Lulu	W. X. Muhlebach ..	,, ..	9,290	5·49	509·56	Pansy's Eminent of Rosemont
10	The Valley Wild Rose ..	Mrs. E. M. Lennie ..	,, ..	10,050	5·06	508·98	Foxglove of the Valley
11	Daffodil of Grangelea ..	A. A. Broad	,, ..	9,519	5·25	500·06	Mistletoe 2nd V.C. of Tarnpirr
12	Kooreena Minerva.. ..	W. H. Hurrey ..	,, ..	9,566	5·16	493·56	Lord 3rd of Brucevale
13	Aria of Banyule	L. J. Herd	,, ..	9,143	5·40	493·32	Wotton Airman
14	Staghorn Master's Madeira	F. Bidgood	,, ..	8,600	5·70	489·94	Werribee Northern Masterpiece
15	Swansea Peggy	Messrs de Soyres Bros.	,, ..	8,006	6·11	488·96	Prince of Belgonia
16	Roseleigh Wisteria ..	Mrs. E. M. Gange ..	Ayrshire ..	12,599	3·87	487·51	Oakbank Reply
17	Lynroy Nancy 2nd ..	Vaughan Bros. ..	Jersey ..	9,653	5·02	485·00	Choice 2nd of Tarnpirr
18	Tooravale Starleigh 2nd ..	J. E. Handbury and Son	,, ..	8,040	6·03	484·92	Welkin of Melrose
19	Wootong Vale Gold Carnation	G. H. Belfield ..	,, ..	9,240	5·22	482·74	Gold Prince of Clover Flat
20	Kyore Sultan's Adore ..	Miss S. L. Robinson ..	,, ..	9,311	5·18	482·16	Foch of Jerrara
21	Blackwood Grove Sweet Surprise	A. E. Ellis	,, ..	7,175	6·67	478·73	Cream Duke of Glen Iris
22	Blackwood Valley Blue Belle's Buttercup	W. T. Jephson ..	,, ..	8,089	5·90	477·10	Retford Mourier Lad

JUNIOR 4 YEAR OLD (Between 4 and 4½ Years) 300 lb Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Aveley Norma 2nd ..	W. P. Rogen ..	Jersey ..	10,002	5·50	550·53	Choirmaster of Banyule
2	Werribee Starbright 10th ..	W. P. Rogen	,, ..	10,311	5·05	520·79	Masterpiece
3	Preston Farm Lass ..	J. J. Desmond ..	,, ..	10,638	4·89	520·49	Pretty King 2nd of Koorawatha
4	Greenvale Mona Keys ..	J. Plattfuss	Friesian ..	14,943	3·41	509·55	Lydholme Segis Paxton
5	The Wattles Lizzie Birt ..	N. H. Enders ..	Jersey ..	9,255	5·47	506·16	Prince of Wales of Hillcrest
6	Edmonton Vixen	H. Cowling	,, ..	8,184	6·13	501·70	Big Chief of Glen Iris
7	Aconite of Springhurst ..	J. D. Read	,, ..	8,454	5·92	500·89	Othman of Springhurst
8	Ipomea 2nd of Swansea ..	J. Clyne	,, ..	8,805	5·57	490·78	Prince of Belgonia
9	Staghorn Master Lark's Laburnum	F. Bidgood	,, ..	8,802	5·48	482·17	Masterpiece
10	Belgonia Marie 4th ..	P. J. Maloney	,, ..	7,935	5·92	469·99	Aerial of Banyule
11	Enterprize Tilly	Fairchild and Clutterbuck	,, ..	9,543	4·92	469·72	Royal Gem of Somerville
12	Burnbank Pictertje Bainfield	A. E. Enders	Friesian ..	13,700	3·37	462·36	Burnbank Delhurst Pictertje
13	Glenvalley Quick Sand ..	J. A. Huffer	Jersey ..	7,919	5·81	459·80	Waverley's Count of Glenvalley
14	Austral Valley Fairy Queen	R. M. Chirnside ..	,, ..	6,788	6·77	459·57	Lily 3rds Prince of Ferntree Vale
15	Glenvalley Waverley Lass 2nd	J. A. Huffer	,, ..	7,443	6·13	455·93	Top Note of Glenvalley
16	Kyora Golden Jazz ..	R. Poyner	,, ..	8,665	5·23	453·29	Foch of Jerrara
17	Beverley Wattle Blossom ..	W. H. Atherton ..	,, ..	9,405	4·80	451·61	Rosella's Lad of King's Vale
18	Beauty of Castlemaddie ..	I. McErvale and Sons ..	,, ..	7,280	6·20	451·60	King's Bounty of Somerville

SENIOR 3 YEAR OLD (Between 3½ and 4 Years) 275 lb. Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Werribee Fancy's Madeira 4th	J. Clyne	Jersey	8,444	5·90	498·55	Masterpiece
2	Lucerne Vale Trixie 2nd	N. C. De La Rue	,,	8,120	6·11	496·22	Lord Phyllis of Bruce Vale
3	Werribee Day Starbright	C. Nathan	,,	9,189	5·40	496·22	Masterpiece
4	Ronnay Lady's Love	E. J. Vagg	,,	7,753	6·39	495·57	Mona's Duke of Woorayl
5	Kantara Wildflower	W. P. Rogen	,,	9,546	5·10	486·95	Ku Ku Fashion Plate
6	Model 2nd of Ballara	F. Trevaskis	,,	9,932	4·86	482·76	Werribee Madeira Cream's Masterpiece
7	Willow Park Melba 2nd	W. K. Atkinson	Milking Shorthorn	11,484	4·20	482·60	Willow Park Count
8	Odense Larkspur	N. H. Enders	Jersey	9,192	5·18	475·71	Prince of Belgonia
9	Karoola Honey Bee 3rd	H. W. King	,,	9,033	5·21	470·44	Pretty King of Koorawatha
10	Preston Sunray	G. T. Young	,,	8,165	5·63	459·81	Preston Merry Lad
11	Grangelea Primrose	A. A. Broad	,,	8,337	5·50	458·95	Misteltoe's 2nd V.C. of Tarnpirr
12	Eurungee Graceful Duchess	J. J. Desmond	,,	8,008	5·71	457·50	King William of Rochdale
13	Maiwand Floss	G. Esler	,,	9,048	5·05	456·89	Duke of Belgonia
14	Willow Park Damsel 2nd	W. K. Atkinson	Milking Shorthorn	10,358	4·36	451·85	Willow Park Reflector
15	Studleigh Vanilla 2nd	W. Fixter	Jersey	7,710	5·81	448·29	Studleigh Son of Chevy
16	Wootong Vale Golden Rose	G. H. Belfield	,,	10,038	4·47	448·27	Gold Prince of Colver Flat
17	Keepsake Treasure of Swansea	F. P. Stephens	,,	6,744	6·62	446·28	Lily's Progress of Swansea
18	Rosebud Perree's Fancy of Glenvalley	J. A. Huffer	,,	9,098	4·90	445·48	Perree's Lad of Glenvalley
19	Wompini Vanillia	L. R. Archibald	,,	9,051	4·91	444·21	Werribee Masterman
20	Rosemont Daisy 4th	R. H. Maher	,,	7,433	5·95	442·03	Rosella 2nd Noble of Rosemont
21	Lumeah Sunbeam	J. Charlton	,,	8,176	5·40	441·13	Burnside Invincible
22	Dookie Flora	Dookie Agricultural College	Ayrshire	10,155	4·33	439·47	Majestic of Burwood
23	Somerville Daphne 2nd	J. Hutchinson and Sons	Jersey	8,267	5·30	438·34	His Majesty of Somerville
24	Willow Park Camelia 3rd	W. K. Atkinson	Milking Shorthorn	10,983	3·97	435·78	Willow Park Design
25	Esperance Joy Bell	S. R. Fuller	Jersey	7,915	5·49	434·72	Werribee Madeira Cream's Masterpiece
26	Clarendon Eyre Little Buttercup	J. V. M. Wood	,,	7,355	5·87	431·60	Rose's Eminent of Clarendon Eyre
27	Rainga Mercedes Golden Princess	P. H. Lawrence	,,	8,387	5·13	430·26	General of Roselands
28	The Valley Poppy 2nd	Mrs. E. M. Lennie	,,	6,653	6·46	429·48	Black Thorn of Fairview
29	Fuchsia 9th of St. Albans	R. M. Chirnside	,,	7,983	5·36	428·07	Twylish Expectation of Banyule
30	Banyule Silvermine 45th	C. G. Lyon	,,	7,982	5·36	427·69	Wotton Airman

JUNIOR 3 YEAR OLD (Between 3 and 3½ Years) 250 lb. Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Preston Lady Capture 2nd	T. J. Scott	Jersey	11,037	5·77	636·60	Preston Fancy Mite
2	Staghorn Master's Fancy 2nd	F. Bidgood	,,	8,912	6·22	554·76	Werribee Northern Masterpiece
3	Greenvale Dutch Girl	J. Plattfuss	Friesian	14,921	3·53	526·95	Lydholme Segis Paxton
4	Staghorn Master's Bell	F. Bidgood	Jersey	8,096	6·23	504·32	Werribee Northern Masterpiece
5	Glenlock Pearl	H. A. Cooper	,,	8,748	5·61	491·16	Rajah of Springhurst
6	Staghorn Master's Fancylark	F. Bidgood	,,	8,930	5·36	478·97	Werribee Northern Masterpiece
7	Normandie Ilma	L. W. Colenso	,,	9,185	5·21	478·67	Thelma's King of St. Albans
8	Dalray Larkspur Surprise	G. H. Belfield	,,	7,553	6·03	455·69	Twinkle's Twylish of Aveley
9	Rydon Petal	G. & W. Smith	,,	7,498	6·05	453·29	Prince Bob of Glen Moor
10	Banyule Molly 26th	C. G. Lyon	,,	8,313	5·43	451·47	Wotton Airman
11	Burnbank Fraulin Patch	A. E. Enders	Friesian	11,430	3·94	450·61	Rock Patch
12	Warenda Agnes 5th	T. Mesley	Jersey	6,555	6·76	443·05	Kinnor of Banyule
13	Staghorn Master's Cello	F. Bidgood	,,	7,791	5·67	441·58	Werribee Northern Masterpiece
14	Kantara Spring Flower	W. Rogen	,,	8,649	5·10	441·28	Ku Ku Fashion Plate
15	Ellendale Kersty 3rd	Quigley and Bennett	,,	8,316	5·29	440·16	Mistletoe 2nd's Treasure of Lynuilg
16	Moorooduc Azalie	J. Unthank	,,	8,613	5·00	430·72	Repulse of Somerville
17	Clyde Vale Bright Star	J. Dee	,,	7,035	6·04	424·61	Marmion of St. Johns
18	Werribee Fancy's Madeira 3rd	J. P. Chirnside	,,	7,335	5·78	423·60	Werribee Starbright King 2nd
19	Banyule Ettie 11th	C. G. Lyon	,,	7,601	5·87	423·01	Noble Airman of Banyule
20	Preston May Day	J. J. Desmond	,,	7,638	5·52	421·64	Pretty King 2nd of Koorawatha
21	Coolwoola Montrose Firefly	F. P. Stephens	,,	8,120	5·19	421·19	Montrose Dancer of Glen Iris
22	Eildon Choice Queen	L. W. C. Holbing	,,	8,458	4·98	420·98	Last Choice of Belgonia
23	Wompini Joybell	Simpson and Son	,,	7,583	5·55	420·66	Werribee Masterman
24	Ballara Ideal	F. Trevaskis	,,	7,668	5·47	419·71	Werribee Madeira Cream's Masterpiece
25	Warenda Gazelle 8th	T. Mesley	,,	8,133	5·12	416·34	Warenda Snap

JUNIOR 3 YEAR OLD (BETWEEN 3 AND 3½ YEARS) 250 LB. STANDARD—*continued.*

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
26	Wattle Vale Golden Girl	A. P. Prout	Jersey	7,265	5·68	412·81	Duke of Melrose
27	Willis Vale Pretty Vanity	E. B. Neave	,,	7,511	5·48	411·40	Pretty King of Willis Vale
28	Greenvale Rosie Keys	J. Plattfuss	Friesian	12,977	3·15	408·13	Dominion Oakwood
29	Hazeldale Bracelet	Simpson and Son	Jersey	7,476	5·41	404·25	Lord Mannikin of Hazeldale
30	Willis Vale Captor's Pride	R. Stockdale	,,	8,474	4·76	403·37	Kings Capture of Willis Vale
31	Rosemont Lassie Fowler 3rd	R. Maher	,,	7,382	5·45	402·60	Rosella 2nds Noble of Rosemont
32	Glen Leigh Foxglove	J. E. Chadderton	,,	7,140	5·63	401·73	Gadabout of Danton
33	Jerseyholm Empress 10th	T. Harvey	,,	6,785	5·90	400·30	Handsome Boy 5th of Melrose
34	Wattle Grove Junee	R. J. M. Dobson	,,	6,641	6·03	400·15	Bosun of Meadow Vale

SENIOR 2 YEAR OLD (Between 2½ and 3 Years) 225 lb. Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lb.		lb.	
1	Maiwand Stockings	G. Esler	Jersey	8,019	6·27	502·89	Maiwand Chief
2	The Wattles Myra's Choice	N. H. Enders	,,	8,282	6·05	501·25	Choice Prince of Belgonia
3	Glenleigh Duchess	J. Chadderton	,,	8,507	5·82	495·31	Gadabout of Danton
4	Greenwood Athalie	K. McGarvie	,,	7,263	6·66	483·81	Retford Peer
5	Kooreena Minerva 2nd	W. H. Hurry	,,	7,913	6·09	481·58	Columbine Defiance of Linga Longa
6	The Wattles Fairy	N. H. Enders	,,	8,684	5·48	476·25	Choice Prince of Belgonia
7	Runica's Jessie	A. Fixter	Guernsey	7,725	6·10	471·11	Werribee Jessie's Boy
8	Greenwood Aurora	K. McGarvie	Jersey	8,820	5·33	470·00	Retford Peer
9	Wattle Grove Sunflower	R. J. Dobson	,,	8,282	5·63	465·90	Admiral of Fairview
10	Fourshells Princess Hope	F. P. Stephens	,,	8,543	5·45	465·63	Prince 2nd of Belgonia
11	Fourshells Marie's Aerial Queen	F. P. Stephens	,,	8,937	5·14	459·58	Aerial of Banyule
12	Springhurst Yarran	J. D. Read	,,	7,337	6·17	452·87	Starbright's Prince of Glen Iris
13	Springhurst Tecoma 3rd	J. D. Read	,,	7,181	6·30	452·71	Starbright's Prince of Glen Iris
14	Waratta Ellen Bell	J. J. Desmond	,,	8,589	5·18	444·90	Jubilee Lifelight
15	The Wattles Duchess Choice	N. H. Enders	,,	7,502	5·92	444·11	Choice Prince of Belgonia
16	Studleigh Duchess 3rd	Cameron and Son	,,	6,696	6·48	434·18	Lord 5th of Bruce Vale
17	Glen Valley Silver Bell	J. A. Huffer	,,	7,247	5·94	430·70	Waverley's Count of Glen Valley
18	Willow Park Dainty 3rd	W. K. Atkinson	Milking Shorthorn	10,805	3·96	428·03	Willow Park Design
19	Clarendon Eyre Lilac Domino	J. V. M. Wood	Jersey	7,011	6·10	427·68	Rose's Eminent of Clarendon Eyre
20	Lynroy Nancy 3rd	Vaughan Bros.	,,	6,782	6·28	425·98	Choice 2nd of Tarnpirr
21	Kyora Dream Girl	E. Middleton	,,	7,167	5·80	415·95	Perree's Duke
22	Kooreena Maranta	W. Hurry	,,	7,020	5·92	415·27	Kooreena Carrie 3rds Idol
23	Staghorn Masters Beauty	Foster Bros.	,,	7,695	5·38	414·22	Werribee Northern Masterpiece
24	Karoola Marie	W. H. King	,,	7,589	5·44	413·13	Waverley's Count of Glen Valley
25	Kooreena Mourier Queen	W. Hurry	,,	6,932	5·95	412·73	Kooreena Carrie 3rds Idol
26	Studleigh Harebell 2nd	Cameron and Sons	,,	7,130	5·75	409·96	Werribee Madeira Starbright's King
27	Waratta Edna Bell	J. J. Desmond	,,	7,679	5·32	408·71	Jubilee Lifelight
28	Rosemont Lady Fowler 4th	R. H. Maher	,,	6,993	5·84	408·16	Rosella 2nds Noble
29	Ballara Bluebell	F. Trevaskis	,,	7,141	5·71	407·84	Werribee Madeira Cream's Masterpiece
30	Hyde Park Daphne 2nd	Telford Bros.	Ayrshire	9,603	4·24	407·03	Bell Boy of Ben Kell
31	Eurobin Silvia Girl	A. E. Enders	Friesian	12,207	3·30	403·14	Burnbank Inka Sylvia Alcartra
32	Swansea Fuchsia 2nd	J. Clyne	Jersey	7,248	5·51	399·40	Prince of Belgonia
33	Ballara Romany Lass	F. Trevaskis	,,	7,774	5·10	396·46	Werribee Madeira Cream's Masterpiece
34	Cooel Masters Florrie 2nd	Mrs. L. Lowing	,,	7,539	5·25	395·83	Werribee Masterman
35	Blackwood Valley Queen	W. Hurry	,,	6,299	6·28	395·53	Retford Mourier Lad
36	Banyule Hawthorn 15th	C. G. Lyon	,,	7,634	5·16	393·75	Air Lord of Banyule
37	Ewelme Masters Pearl	C. Chitty	,,	6,722	5·84	392·47	Northern Master of Glen Iris
38	View Point Golden Bright	E. Day	,,	6,219	6·30	392·04	Keepsake's Treasure of Lynuilg
39	Grangelia Defenders Favourite	E. Neave	,,	6,899	5·65	389·57	Mistletoe's 2nd V.C. of Tarnpirr
40	Kantara Brooklet	W. P. Rogen	,,	7,628	5·05	385·57	Kantara Great Gun
41	Victoria Domino Patch	Department of Agriculture	Friesian	10,835	3·53	382·13	Victoria Patch
42	Ballara Starbright 2nd	F. Trevaskis	Jersey	7,343	5·20	381·81	Werribee Madeira Cream's Masterpiece
43	Greenwood Alma	K. McGarvie	,,	6,755	5·64	380·97	Retford Peer
44	Melrose Handsome Girl 14th	J. A. Huffer	,,	6,125	6·22	380·73	Sunset of Melrose
45	Somerville Northern Maid	Barber Bros.	,,	6,830	5·57	380·11	Repulse of Somerville
46	Studleigh Dianthus 3rd	Cameron and Sons	,,	6,588	5·77	379·82	Studleigh Progress
48	Aveley Silvermine 3rd	L. J. Herd	,,	6,795	5·59	379·63	Choirmaster of Banyule
48	Glenmavis Noble Gift	S. Bolton	,,	6,036	6·25	377·47	Noble Airman of Banyule
49	Boveagh Yvette	F. Stephens	,,	6,245	6·03	376·69	Duke 2nd of Belgonia
50	Greenwood Augusta	K. McGarvie	,,	6,414	5·87	376·44	Retford Peer

JUNIOR 2 YEAR OLD (Under 2½ Years) 200 lb. Standard.

Order of Merit.	Cow.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Sire.
				lc.		lb.	
1	Airlie Duchess 2nd ..	Ducat and Sons ..	Jersey ..	9,587	5·27	505·36	Twist of Banyule
2	Troed-yr-Rhiw Tawelwych ..	Mrs. L. Lowing ..	,, ..	8,363	5·68	474·69	Cymo of Belgonia
3	Arishma Joyful	N. H. Enders ..	,, ..	9,929	4·74	470·74	Burnside Majestic
4	Belgonia Peggy 6th ..	P. J. Maloney ..	,, ..	8,311	5·64	469·06	Aeriel of Banyule
5	Staghorn Masters Larkspur	F. Bidgood	,, ..	8,096	5·67	458·66	Werribee Northern Masterpiece
6	Tooravale Princess 5th ..	J. Handbury and Sons	,, ..	8,100	5·45	457·70	Welkin of Melrose
7	Studleigh Harebell 3rd ..	Cameron and Sons ..	,, ..	7,794	5·77	449·92	Werribee Madeira Starbright's King
8	Clarendon Eyre Happy Days	J. V. M. Wood ..	,, ..	8,343	5·20	433·77	Eminents Achievement of Clarendon Eyre
9	Warenda Garenne 11th ..	T. Mesley	,, ..	7,307	5·93	433·55	Warenda Snap
10	Fourshells Hope	F. P. Stephens ..	,, ..	6,659	6·45	429·39	Propellor of Belgonia
11	Staghorn Masters Belle ..	F. Bidgood	,, ..	6,933	6·14	425·46	Werribee Northern Masterpiece
12	Leven Brae Queenie ..	F. R. Findlay ..	,, ..	6,530	6·47	422·69	Werribee Gay Boy
13	Balcairn Lady	A. F. Dowie	,, ..	7,931	5·30	420·30	Werribee Raleigh
14	Delmont Medusa	R. E. Huggins ..	,, ..	6,980	6·02	420·27	Werribee Wyandotte's King
15	Somerville Duchess ..	Fairchild and Clutterbuck	,, ..	7,948	5·27	419·02	Repulse of Somerville
16	Strathbow Goldie 5th ..	F. Raggatt	,, ..	6,714	6·17	414·58	Studleigh Noble
17	Kantara Nanette	W. P. Rogen	,, ..	7,971	5·18	413·17	Ku Ku Fashion Plate
18	Staghorn Masters Belle 2nd	F. Bidgood	,, ..	7,296	5·66	412·95	Werribee Northern Masterpiece
19	Riversdale Opera Queen ..	W. C. Cayley ..	Ayrshire ..	8,946	4·50	402·63	Hot Stuff of Sparrovale
20	Lyndale Pansy	R. Stockdale	Jersey ..	7,373	5·44	401·44	Sunsets Duke of Woorayl
21	Warenda Gazelle 7th ..	T. Mesley	,, ..	6,233	6·43	400·85	Snap of Warenda
22	Fourshells Princess Hope ..	F. P. Stephens ..	,, ..	7,581	5·28	400·06	Prince 2nd of Belgonia
23	Ballara Garenne's Fancy 3rd	F. Trevaskis	,, ..	6,644	6·01	399·45	Werribee Madeira Creams Masterpiece
24	Xavier Handsome Girl ..	Mrs. E. Crawford ..	,, ..	7,334	5·43	398·33	Mozart of Warenda
25	Mornmoot Modesty ..	R. M. Chirnside ..	,, ..	5,816	6·77	393·80	Air Pilot of Banyule
26	Arishma Joyful	N. H. Enders ..	,, ..	8,223	4·79	393·62	Burnside Majestic
27	Brucevale Molly Merribee Madeira	J. P. Chirnside ..	,, ..	5,444	7·21	392·55	Masterpiece of Brucevale
28	Glenvalley Quick Countess ..	J. A. Huffer	,, ..	7,304	5·37	391·95	Waverley's Count of Glenvalley
29	Banyule Silvermine 46th ..	C. G. Lyon	,, ..	7,620	5·12	390·28	Wotton Airman
30	Maxon Mercedes Buttercup	McNabb and Son ..	,, ..	7,751	5·02	389·43	Mercedes Chief 7th of Avalon
31	Greenwood Belvidera ..	K. McGarvie	,, ..	7,517	5·16	387·96	Graceful Duke of Greenwood
32	Clarendon Eyre Iolanthe ..	J. V. M. Wood ..	,, ..	7,177	5·38	386·46	Eminents Achievement of Clarendon Eyre
33	Wattle Grove Sunbeam ..	R. J. Dobson ..	,, ..	8,340	4·63	385·87	Alert of Farringdon
34	Clover Flat Glossy 2nd ..	J. E. Chadderton ..	,, ..	7,164	5·37	384·88	Beau Brummel of Banyule
35	Spring Vale Cordyline Inka ..	A. J. Eldridge ..	Friesian ..	10,380	3·69	383·40	Bolobek Top Gallant
36	Parkview Shirley	J. McDougall ..	Jersey ..	6,774	5·64	382·28	Cream Lad of Parkview
37	Brucevale Fancy Starbright 3rd	J. P. Chirnside ..	,, ..	5,885	6·49	382·03	Masterpiece of Brucevale
38	Hope 3rd of Bona Vista ..	D. M. Ryan	Illawarra Shorthorn	10,640	3·59	382·02	Jellicoe of Greyleigh
39	Taranah Heather	C. W. Macaulay ..	Jersey ..	5,921	5·55	381·81	Royal Rose's Choice of Tarnpirr
40	Mornmoot Marjorie ..	R. M. Chirnside ..	,, ..	6,209	6·14	381·47	Burnside Banker
41	Ewelme Northern Necklace ..	C. Chitty	,, ..	6,171	6·17	380·93	Northern Master of Glen Iris
42	Victoria Joyous Piebe ..	Department of Agriculture	Friesian ..	10,501	3·62	380·79	Victoria Joyous Mercedes
43	Boorene Silver Light ..	McNabb and Son ..	Jersey ..	6,309	5·97	376·67	Lady Grey's Silvermine 2nd of Somerset
44	Spring Vale Lorna Patch ..	A. J. Eldridge ..	Friesian ..	10,983	3·41	374·18	Burnbank Iona Patch
45	Glenburnie Daffodil ..	E. P. Hayes	Jersey ..	6,291	5·95	373·97	Valda's King of Comely Banks
46	Belgonia Romany Lass 4th	Quigley and Bennett ..	,,	7,337	5·09	373·81	Aerial of Banyule
47	Belgonia Buttercup 3rd ..	P. J. Maloney ..	,, ..	5,784	6·46	373·81	Aerial of Banyule
48	Victoria Royal Blue ..	Department of Agriculture	Red Poll ..	7,664	4·87	373·25	Victoria Vice Regal
49	Greenwood Beloved ..	K. McGarvie	Jersey ..	6,212	5·97	370·75	Retford Peer
50	Clarendon Eyre Little Buttercup 2nd	J. V. M. Wood ..	,, ..	6,303	5·87	370·23	Clarendon Eyre Rose's Eminent
51	Warenda Mandolin 4th ..	T. Mesley	,, ..	6,444	5·71	367·88	Warenda Snap
52	Clarendon Eyre Waltz Dream	J. V. M. Wood ..	,, ..	6,618	5·53	367·85	Eminent's Achievement of Clarendon Eyre
53	Clarendon Eyre Rose Marie	J. V. M. Wood ..	,, ..	7,007	5·24	367·01	Clarendon Eyre Eminent One
54	Delmont Dolores	R. E. Huggins ..	,, ..	5,538	6·60	365·59	Werribee Wyandotte King
55	Dalray Fairy Queen ..	K. D. Lane	,, ..	6,499	5·62	365·09	Glenlock Sultan
56	Narrawong Twylish Maid 2nd	R. Purnell	,, ..	6,189	5·87	363·05	Garantie's Hero of St. Albans
57	Jerseyholme Blue Bell 9th ..	T. Harvey	,, ..	7,149	5·05	361·14	Lord Island of Brucevale
58	Springhurst Nightshade 3rd	J. D. Read	,, ..	5,481	6·59	360·95	Starbright's Prince of Glen Iris
59	Willow Park Moss Rose 3rd	W. K. Atkinson ..	Milking Shorthorn	9,900	3·64	360·60	Willow Park Reflector
60	Glenlock Milkmaid ..	H. A. Cooper	Jersey ..	6,965	5·18	360·55	Milkmaid's Chief of Banyule
61	Jerseyholm Empress 15th ..	T. Harvey	,, ..	6,713	5·36	359·83	Werribee Master's Fox
62	Wompini Vasilika ..	T. Noble and Son ..	,, ..	6,528	5·50	359·03	Werribee Masterman
63	Preston Daffodil	G. T. Young	,, ..	6,888	5·20	358·30	Preston Merry Lad
64	Glenmavis Nancy	S. Bolton	,, ..	7,244	4·91	355·65	Clyde King 3rd of Rosedale View
65	Glenmavis Surprise ..	S. Bolton	,, ..	7,205	4·92	354·30	Clyde King 3rd of Rosedale View
66	The Wattles Molly ..	N. H. Enders ..	,, ..	6,308	5·60	353·47	The Wattles Myra's Lad
67	Scottsville Mona	B. R. O'Meara ..	Ayrshire ..	8,625	4·08	352·10	Scottish Lord of Gowrie Park
68	Melrose Jenny Lind 23rd ..	W. Woodmason ..	Jersey ..	6,432	5·45	350·38	Masterpiece

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The great Drought-resistant Fodder.
Imported, **6d.** lb.; **46/8** cwt.
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Each: **5d.** lb.; **37/4** cwt.

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1/7 lb.; **1/6** lb. in 28 lb. lots; **1/5** lb. in ½ cwt. lots; **1/4** lb. in 300 lb lots.

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1/6 lb.; **1/5** lb. in ¼ cwt. lots; **1/4** lb. in 1 cwt. lots; **1/3** lb. in 300 lb. lots.

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Giant Kangaroo: **9d.** lb.; **74/8** cwt.
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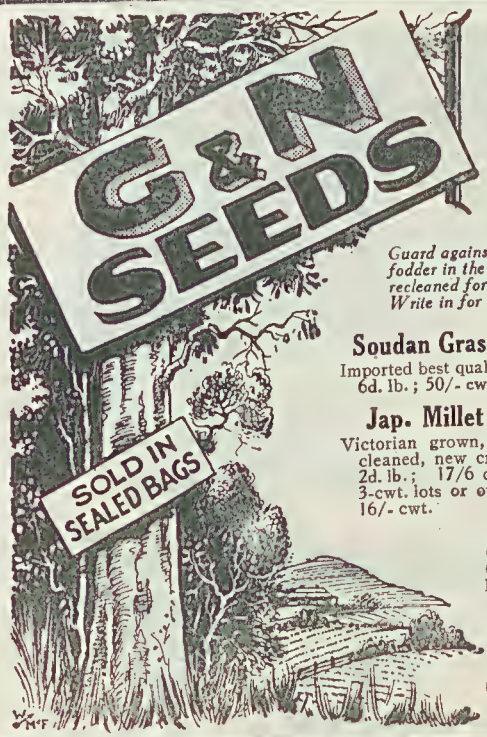

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Thousand-headed Kale, 2/- lb.

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Giant Upright Broad-leaf, triple-cleaned, 1/6 lb.; ½-cwt. lots, 1/5 lb.; Cwt. lots, 1/4 lb. Hunter River, machine-dressed, 1/5 lb.; ½-cwt. lots, 1/4 lb.; Cwt. lots, 1/3 lb. Westernport Evergreen Lucerne, clean quality, 7/6 oz.

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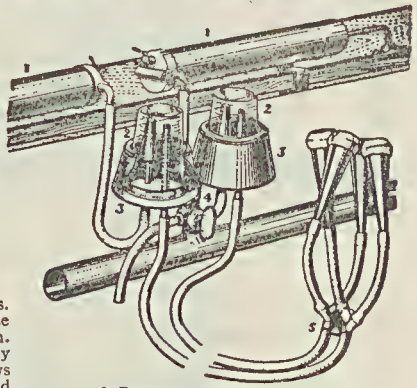

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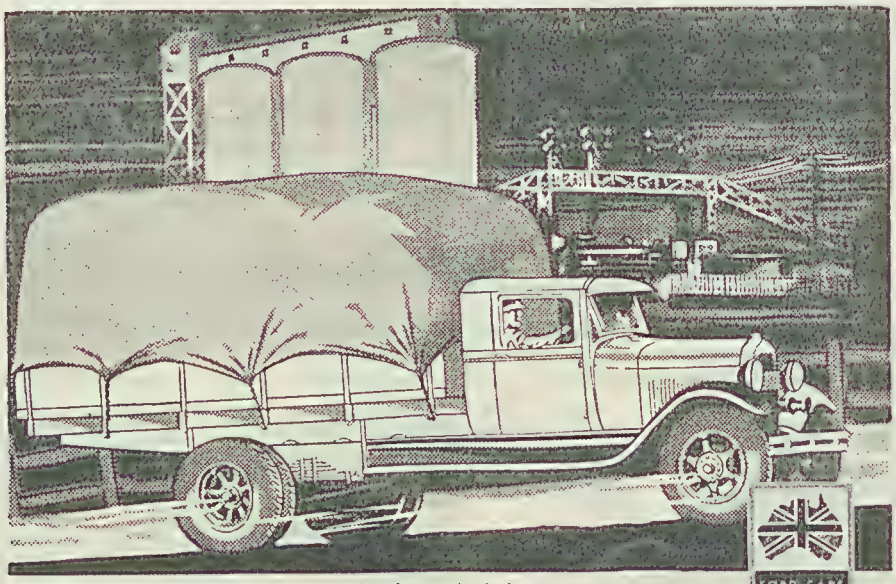

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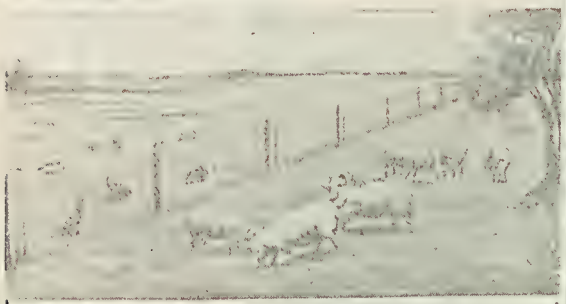

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Settings of Eggs can be supplied in season
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POULTRY FOOD

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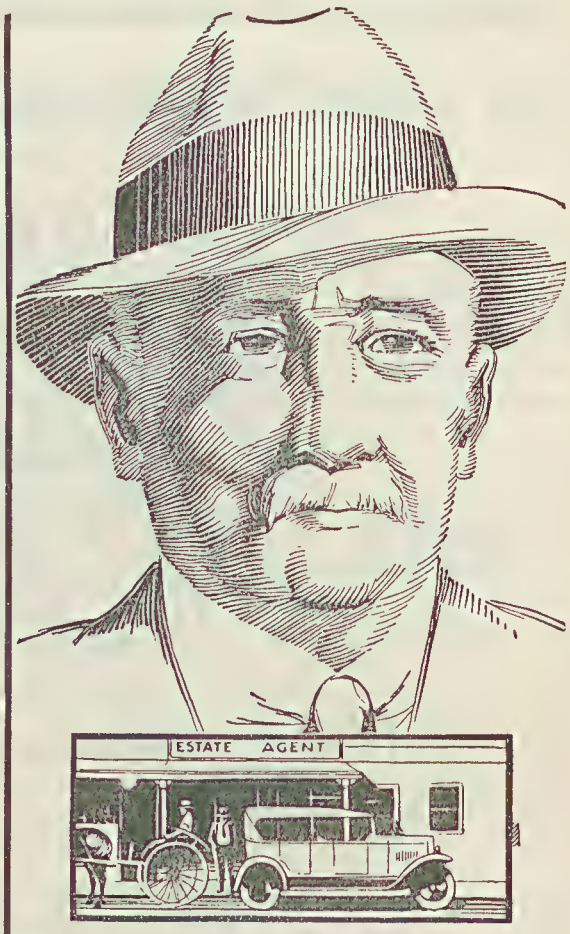

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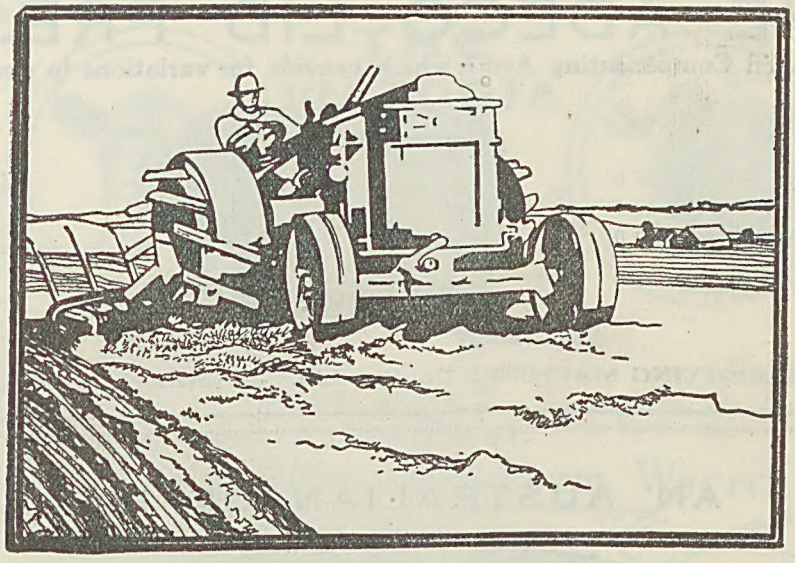

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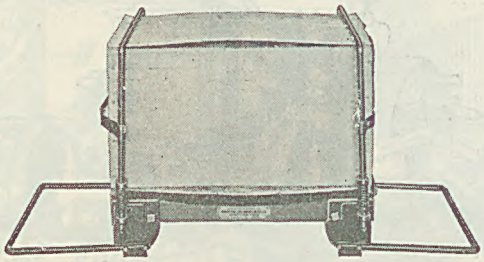

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Dam ... Victoria La Regal (718 A)

25 Guineas

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Dam ... ... Victoria Braid (1654 A)

20 Guineas

3. *Born* .. ... 11th February, 1931
Sire .. ... Dominion Bright Belgian
Dam ... Victoria Euphrates (716 A)

24 Guineas

4. *Born* ... ... 28th August, 1931
Sire ... ... Dominion Bright Belgian
Dam ... Victoria Tinka Bell (2434 B)

10 Guineas

5. *Born* ... ... 11th September, 1931
Sire ... Dominion Bright Belgian
Dam ... Victoria Barcarolle (2303 A)

17 Guineas

The prices quoted are based on the butter-fat production of the dam at the rate of 1/- per lb., except in the case of progeny of heifers without completed test, the price then being 10 guineas.

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